THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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	Page
Increasing the Output	813
Electricity in Farming	814
Responsibilities of Directors	814
Copper	815
Copper Wire Manufacturers and the Contraband Problem	815
Men who Stay at Home	815
Battery-Bell Signalling Systems in Mines	816
Wireless Call Devices, by L. B. Turner (*illus.*)	817
Röntgen Society	818
A Glasgow Hospital (*illus.*)	819
Scientific and Technical Commissioners, by W. P. Digby	819
New Electrical Devices, Fittings and Plant (*illus.*)	820
War Items	821
Reviews	823
Legal	824
Business Notes	824
Notes	830
City Notes	833
Stocks and Shares	835
Electric Tramway and Railway Traffic Returns	835
Share List of Electrical Companies	836
Market Quotations	836
Electricity in Farming.—II. (*illus.*)	837
The New Turbine Plant of the Interborough Co., New York (*illus.*)	840
Load Factor, Output and Cost, by C. Ashmore Baker (*illus.*) (*concluded*)	841
Correspondence—	
Munitions of War	843
Automatic-Lift Accidents	843
Cable Shortage	843
Appointments Vacant	843
Cab Signalling	843
Overseas Trade—Nothing Done	844
New Patents Applied for, 1915	844
Abstracts of Published Specifications	844
Contractors' Column	Advertisement page xviii

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THE UNIVERSAL ELECTRICAL DIRECTORY

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INCREASING THE OUTPUT.

FOR more than 20 years past the pages of our own and other journals concerned with engineering industry have published criticisms of the disposition of Labour to limit output. Organised Labour blatantly claimed the right to say how many hours' work a man should do in a day, to define when and where a particular class of worker should end his operations and another class begin, and to limit the efficiency of the individual worker and the capacity of the equipment with which he did his work. Employers fought such tendencies again and again and were attacked because they were Capitalists. That there were rights and wrongs on both sides we never failed to acknowledge, but we have unhesitatingly and consistently tried to show that the restrictive and limiting tendency was harmful to both Capital and Labour, and was altogether opposed to the best interest of British engineering industry.

At the time of the engineering strike of 1897 it was stated that funds which were raised to assist strikers and their families in their fight against British industrial leaders included subscriptions from Germany, whose manufacturers received contracts purely because closed English factories were unable to handle them. We have no desire at this date to set muddy water in motion, but we cannot help remembering such incidents when we observe the tendency that has been so often and so loudly denounced as hampering our great industries, singled out for attack by the Minister of Munitions, because in the present time of crisis it is imperative that we secure the maximum output of everything that is essential for the successful conduct of the war. Mr. Lloyd George addressing Manchester engineers last week said that Labour must be directed and controlled by the State to that one vital end. He showed that regulations, customs, and practices imposed by Unions in times of peace were utterly inapplicable and out of place in the terrible urgency of war. Objections to working more than so many hours per day, because "my Trade Union won't allow it"; or to increasing output because "my Trade Union won't allow me to do more than my share"; or the refusal to work beside an untrained man because it is "against my Union's regulations"—objections which have hampered national industry for years—are not to be permitted to stand in the way in these days. The Minister of Munitions and the Coalition Government may have to use their powers under the Defence of the Realm Act if men are blind to the interests of the Empire, or are not prepared to meet willingly their obligations to those who are holding the seas or fighting in one of the many battlefields on which bloody slaughter is proceeding in combat with "the most formidable antagonist that ever attacked human liberties."

At the end of Mr. Lloyd George's speech, representatives of the Manchester Engineering Employers' Federation and

of the Amalgamated Society of Engineers, declared the readiness of Lancashire engineering employers and Trade Unions alike to support in every possible way the great national effort to increase the production of war material. It seems inconceivable that when the issues involved are such as to make even the man in the street exclaim: "Victory or Death!" there should be any holding back of effort in the factory.

The fight has to be a fight to the finish, or we may lose all that we cherish or hold dear, all the freedom and honour and liberty that our fathers have struggled and fought for. But in order to render that freedom and liberty inviolable for the generations that follow, surely both masters and men will see the necessity for obedience to those who as our national leaders are striving so to organise our works and our labour that there may be no doubt about the ultimate issue.

Mr. Lloyd George said that if he could for a moment make everybody realise the great issues, and grasp the great dangers of the struggle in which we are engaged, there would be but one cry from every home to the Government:—"Convince yourself as to what action is necessary; take it boldly, and we will see you through."

In our old Labour controversies we heard and said much about "Common Interests." Here, if never before, we have "common interests" at stake, and a recognition of that serious truth peremptorily demands universal whole-hearted, self-sacrificing, co-operation.

Electricity in Farming.

Elsewhere in this issue we publish a short account of the steps which have been taken to supply farmers on the outskirts of the city of Hereford with electric light and power; this is the continuation of a general article on the subject of "Electricity in Farming," which commenced in our last issue.

Living for the most part remote from the electrically-developed town areas, and beyond those influences which tend to keep the town-dweller on the alert for something new, there is probably no class of our population less familiar with the economic value of electricity than the farmer class, and yet all the available evidence goes to show that when once he has made the plunge, the farmer, whether in this country or abroad, becomes an enthusiastic user of electricity for both power and lighting, and, incidentally, a consumer of much greater value than the average consumer in any town, unless it be an industrial centre.

Unfortunately, this is not generally appreciated by our central-station engineers—on whom the task of influencing the farmer in things electrical must devolve—and there is therefore every chance of this valuable field for electrical development being neglected, unless those most concerned can be led to interest themselves in the subject.

The results obtained by Mr. Kerr at Hereford are so striking, and present such an object lesson to other central-station engineers within reach of the farming community, that they cannot be ignored by the latter; especially is this the case with the small undertaking, whose rate of progress has been mainly dependent on the almost microscopical growth of a country town.

In the Hereford area the average farm consumer is worth £20 per annum to the electricity department, while the average revenue per consumer from all consumers is between £8 and £9, a figure which probably represents a good average for a non-industrial community of 20-25,000 inhabitants. If a profit can be shown on the latter, it seems obvious that the farm consumer, who can be reached with overhead lines costing about £110 per mile, is a most attractive proposition to the supply engineer.

We have emphasised elsewhere the necessity of showing the farmer the real thing—nothing can take the place of a practical demonstration—and given a good prospective farming area, it would no doubt save time and trouble to come to some agreement with one farmer for the use of his farm for demonstration purposes for a year, possibly in return for a free supply of energy during that period.

This would enable the engineer to test the feeling of his immediate neighbourhood, and to obtain valuable data as to the probable nature of the load, and, no doubt, would assist him in formulating an efficient scheme of supply to commence with.

But this is a digression; the prime necessity of the moment is to bring home to our supply engineers and agriculturalists the mutual advantages of introducing electrical methods on the farm.

There are in the British Isles over 45 million acres of land under cultivation, giving employment to a bigger percentage of the population than any other industry; surely it cannot for a moment be contended that this important section of our national economy is beyond the pale in matters electrical.

With the experience gained under the varied conditions obtaining in half-a-dozen European countries, some of them intensively cultivated, and in the sparsely populated districts of Canada and the States, favourable to the development of electrical methods on the farm, there is every incentive for us seriously to grapple with the problem, which so directly concerns both the electric supply and manufacturing interests of this country.

Responsibilities of Directors.

We have had occasion more than once to advert to the responsibilities which attach to the position of director of a limited company. It is not for nothing that a man allows his name to appear on a prospectus. He is generally paid fees or he acquires certain other advantages for so doing; but it cannot be made too plain that his name is not put on a prospectus for amusement. The law is thus stated in Lord Halsbury's "Laws of England," Vol. V, p. 366: "Directors may incur liability to persons who subscribe for the company's shares or debentures in reliance upon a prospectus which contains material misrepresentations of fact," but "a director is not liable for untrue representations made to the shareholders if he honestly believes the representations to be true, and has reasonable grounds for his belief. Thus, where a company is formed to take over an existing business which turns out to be ruinous, the directors will not be responsible for making the purchase unless the ruinous nature of the business is obvious on the same principle that protects an agent purchasing by authority of his principal." The liability of directors is well illustrated by a case recently decided in the Court of Appeal—Adams *v.* Thrift and Others. The defendants were directors of the Stolz Electrophone Co. (1913), Ltd., a company formed (according to the prospectus) "to take over (*inter alia*) as a going concern the business of the Stolz Electrophone Co. (London), Ltd., and the old-established business of the Homer Earphone Co., of New York." The prospectus stated that the business of the American company had been of a highly remunerative character; that the turnover had increased from £11,923 9s. 5d. in 1910 to £32,615 13s. 3d. in 1913, and that the London company were operating 175 branches and agencies in various parts of the world. It was alleged by the statement of claim, and found as a fact by Mr. Justice Eve, that there was no such company as the Homer Earphone Co. in existence. The learned Judge found that although the defendants personally believed that the statements in the prospectus were true they had no reasonable ground for the belief. One of these directors appealed. As regarded him the Judge had found that, although he knew that the electrophone was not a mere quack affair, and though he had the prospectus signed by three colleagues, this did not afford him a reasonable ground for relief. In giving judgment dismissing the appeal, the Master of the Rolls pointed out that the appellant director "did not ask from any human being information about the particular statements which had been proved to be untrue. He said that the promoter had told him that it was all right. The promoter was the last person in the world whose uncorroborated statement ought

to be relied on by an intending director as a justification for his belief in statements in a prospectus."

From the rarity of the reports of cases of this kind in recent years, it may be presumed that as a rule directors are more cautious than they used to be; but it is manifest that if the directors in the case above mentioned had made the most perfunctory inquiry they would probably have found that the company in question did not exist.

Copper.

There has been a strong and sustained upward movement in the copper market since last writing, and the ultimate limits of the rise have hardly yet been attained, for the demand reported by producers and dealers continues to expand in an alarming fashion, and it is doubtful whether the full increase in production now in progress in America will do more than afford modified relief to the situation. The statistical position is, of course, a matter of considerable anxiety. There is every belief felt that the stocks in the United States have dwindled down to bed-rock figures, but there are no details available. On the other hand, the last European statistics were not good, the stocks of standard copper having increased 5,000 tons during the month, the total stocks in England and France by over 4,000 tons, and the European visible supply by about 2,600 tons during May. This, however, had no damping effect upon sentiment, which, indeed, improves steadily under the rising tendency of the share markets in the United States, accompanied by a large buying on account of the enormous orders for munitions which continue to be placed. There is not the least chance of any cutting down of the war demand on the part of the Allied Governments for many months at the very least, and, indeed, there is talk in America of munition orders being booked into 1917-18. All this tends to check any enthusiasm which might otherwise be felt regarding the termination of hostilities, but it implies at the same time a huge destructive consumption of copper. Whether the world's mines can turn out sufficient material to satisfy the demands of the Allies is becoming open to doubt, while the fact that there are possibilities of serious friction between America and Germany, has induced the United States Government to assume a much more interested air regarding her supplies of munitions.

If the United States comes in as a buyer of copper on anything like the scale necessary to play any part of importance in a world-wide conflict, copper prices must inevitably advance further, and by leaps and bounds. There is not the least doubt that the United States domestic demands have undergone a very wide expansion, which may be only the forerunner of still greater calls made upon her reserves and resources. There has been much more speculative interest in the London market, a good proportion of which has emanated from America, and there should be no illusion as to the strength of the position in which producers now find themselves. They are sold very far ahead, and are in an entirely independent position. A distinct feature is the enormous premium which Lake Superior copper demands over electrolytic, and which arises from the fact that the Allied Governments are, in many cases, insisting upon the use of the former. It is doubtful whether any good purpose is served by this rigid adhesion to time-honoured precedent. Other nations can get along well enough with electrolytic, but in some matters ultra-conservatism is still worshipped here as a fetish. Meanwhile all indications appear to point to a steadily higher level of values, though no doubt with fluctuations in the standard market.

Copper Wire Manufacturers and the Contraband Problem.

In view of the satisfactory inquiries for copper goods, particularly for copper wire for electrical purposes, being daily received by British manufacturers from Germany's chief European markets in Holland, Sweden, Spain, &c., it is becoming a matter for complaint with manufacturers in this country that there are unnecessary precautions and protracted delays for which the War Trade Department of the Board of Trade is responsible. As every manufacturer of contraband goods is aware, the sanction of the War Trade officials has to be obtained before shipment can be made to most, if not all, of the neutral countries adjacent to the German Empire, Austria, &c., and while all business men have long since realised the necessity for some strict supervision from the proper source in preventing war material of any form from entering the territory of our enemies, many are of the opinion that the tedious and circumlocutory manner in which the War Trade officials have been dealing with the subject is unwarrantable, and as restrictive to legitimate trading as it is absurd in theory. The procedures that have to be gone through by manufacturers before sanction for shipment is obtained are thought to be, as a rule, most unnecessary.

Instances have been mentioned where delays of as long as six weeks and two months have occurred before sanction has been obtained to ship goods to countries like Spain and Sweden, and this only after having passed through procedures involving several communications with the War Trade authorities, application for references from the Minister for Foreign Affairs, sworn declaration from the consumer before a notary and legalised by the British Consul, further communications with the Customs authorities in England, and other formalities necessitating loss of valuable time and money.

Men Who Stay at Home.

While we have every sympathy with the movement which aims at getting increased efficiency as a consequence of reorganisation and industrial mobilisation, there is a danger that the enthusiasm of the newspaper Press in this connection may have some other consequences which are not so desirable. We must not forget that it has been laid down for us that our forces have to be mobilised for three purposes:—

(1) Military or naval service; (2) the production of munitions of war, directly and indirectly; (3) the maintenance of our export trade.

We are just a little afraid that in discussing (1) and (2), which are undoubtedly the more immediate necessities of the situation, there is a disposition with those who give little thought to the industrial and financial phases of the matter, to consider the third of the foregoing purposes as being of practically no importance. Now whatever our age or fitness, we are all more or less engaged in heart-searching, trying to discover what we can individually do to help bring the war to a conclusion—and quite right too! But there can be no question that for maintaining even our present reduced flow of exports, which on national financial grounds is shown to be so indispensable, we shall require at home many men who, because they are engaged in mere trade matters and apparently not helping in the conduct of the war, are restless and discontented and unhappy, wondering whether they ought not to throw up what they are engaged upon and do that vague something which they cannot discover. If the present movement organises essential forces and influences lusty youths and factory workers to "play the game" and "do their bit," it will have achieved its purpose, but let us not overlook the fact that there are hundreds, and perhaps thousands, of works which are not required for making war material, and hundreds of thousands of males and females whose services will not be immediately, and perhaps not at all, directly required for fighting or for war factory service. These can be utilised partly in connection with the maintenance of export manufacturing, but they will require suitable staffs and heads to guide and control them. We trust that before long the Government may be able to give us a more definite leading in this matter.

In the meantime, there must be many among our readers who, while they cannot now adopt the original cry of "Business as Usual," will conscientiously feel that, considered from the point of view of national trade and finance, they must for a good many hours of the working week continue to follow their ordinary industrial and trading avocations though they never handle a rifle or anything that has to do with shells.

BATTERY-BELL SIGNALLING SYSTEMS IN MINES.

Home Office Report on the Danger of Ignition of Firedamp-Air Mixtures.

It will be remembered that one of the possible causes of the disastrous explosion at Senghenydd Colliery on October 14th, 1913, put forward at the inquiry, was an electric spark from the signalling wires, and certain tests were made by Dr. Wheeler with the signal bell and battery to prove that a firedamp-air mixture could be ignited. The results of the experiments then made, however, were not conclusive, and Dr. Wheeler has made a further series of experiments at the Home Office experimental station at Eskmeals; his report on these tests has recently been issued.

In his report on the experiments on signalling apparatus carried out for the purposes of the Senghenydd inquiry, he showed that with three Dania cells giving a current (on closed circuit) of 0·45 ampere under a pressure (on open circuit) of 4·5 volts, it was possible by short-circuiting the current in the signal wires to give a signal to produce a spark which would explode a mixture of air and methane when methane was present to the extent of 8·2 per cent. This was certainly a very disturbing observation, and in view of the fact that a large proportion of the electrical signalling apparatus in use in coal mines is affected by this conclusion, the Secretary of State requested Dr. Wheeler to carry out further experiments with the object of "obtaining a system of bare wire signalling which would be free from the danger of ignition of firedamp-air mixtures by the flash produced on breaking circuit at the signal wires." In his present report Dr. Wheeler says: "This object has been attained, inasmuch as it has been found possible to determine with considerable accuracy the limits of voltage, current and self-inductance of an electric circuit, derived from the primary batteries, that can cause ignition of the most sensitive firedamp-air mixture by the flash obtained on breaking the circuit; and at the same time it has been found possible to construct a bell which, while conforming with the requirements of safety as indicated by these limits, gives an adequate signal."

In the previous experiments made with a bell of the pattern used at Senghenydd Colliery it was found that the most sensitive mixtures contained between 7·3 and 9·4 per cent. of methane, and this conclusion has been confirmed by the present series of experiments, which showed that the most sensitive mixtures contained between 7·5 and 9·0 per cent. of methane, the amount of current required for ignition of all mixtures lying between these percentages being practically the same, namely, about 0·2 ampere. With mixtures containing less than 7·5 or more than 9·0 per cent. of methane, the difficulty of ignition rapidly increases, more markedly as the higher limit of inflammability is approached. These limits are 5·6 (lower) and 14·8 (higher) per cent., and the mixture that has methane and oxygen in combining proportions, for complete combustion to form carbon dioxide and steam, contains 9·45 per cent. of methane. In these experiments artificially-prepared pure methane (99·8 per cent. methane) and pure air (containing 20·8 per cent. of oxygen) were used; but as firedamp often contains a considerable proportion of nitrogen, and the air of mines may contain less than 20 per cent. of oxygen, it seemed desirable to determine the ignitability of mixtures of methane and air to which nitrogen had been added. A mixture of oxygen and nitrogen containing 19 per cent. of oxygen was therefore prepared, and a series of determinations was made of the currents required for ignition of various mixtures of methane with this "atmosphere." The voltage of the current and the inductance of the circuit were the same as in the previous experiments, and the result showed that rather more current (about 0·22) was required—presumably because of the defect of oxygen—while the limits of inflammability were 5·8 (lower) and 12·5 per cent. (higher), and the mixture containing methane and oxygen in combining proportions contained 8·65 per cent. of methane.

Provided, therefore, circumstances were to arise whereby a mixture of firedamp and air of these proportions was present during signalling operations, with a current of 0·2 ampere passing, ignition of the gas would take place at the "break" of the circuit; though such circumstances are probably remote, they are very possible, and, consequently, exceedingly dangerous, and it becomes a strict duty of mine owners and managers to remove this danger as far as human agency permits.

The danger is the "break-flash," and the strength or intensity of this depends largely upon the self-induction of the coils forming the bell magnets; in order to determine the effect of such inductance in signalling circuits, "a number of inductances of known magnitudes were made, consisting of coils of silk-covered copper wire wound in layers on cores of wood, so as to be of constant value at all currents. These were introduced into the circuit from a battery of dry cells, and the current at 90, 60, 30, or 15 volts required for ignition of different mixtures of methane and air by the break-flash determined." The results obtained with current at 90 volts were as follows:—

Self-induction of circuit.	Current required for ignition.			
	6·0 per cent. methane.	7·0 per cent. methane.	7·5 per cent. methane.	8·0 per cent. methane.
0·00815 henry	1·52 amp.	1·18 amp.	1·05 amp.	0·94 amp.
0·03175 „	0·84 „	0·52 „	0·46 „	0·42 „
0·06350 „	0·50 „	0·32 „	0·28 „	0·26 „
0·09510 „	0·40 „	0·23 „	0·20 „	0·19 „

From this "it will be seen that the amount of current required for the ignition of any of the mixtures increases rapidly so soon as the self-induction of the circuit falls below about 0·03 henry. Results of the same order were obtained with current at 60, 30 and 15 volts."

Dr. Wheeler found that the amount of current in a circuit—as might be expected—was of far greater importance than the voltage as regards the igniting power of the flash produced on breaking the circuit, and especially with highly inductive circuits. Thus, an 8 per cent. methane-air mixture was ignited by the break-flash with a current of from 0·24 to 0·25 ampere, at any voltage between 10 and 30, the self-induction of the circuit being 0·095 henry. The results up to 90 volts were as follows:—

Voltage.	Current required for ignition (8 per cent. mixture).
10	0·25 ampere
12·5	0·245 „
15	0·24 „
30	0·24 „
60	0·22 „
90	0·19 „

At 90 volts, which is well above the arcing pressure, rather less current, it will be noticed, is required for ignition, but, on the other hand, if the current is only 0·18 ampere, "hundreds of break-flashes can be made in the mixture without causing its ignition, whereas with 0·19 ampere ignition occurs at the first break-flash."

Summarising then (*a*) the most readily ignitable mixtures of methane and air contain between 7·5 and 9 per cent. of methane, and the susceptibility to ignition by sparks of the firedamps of different mines varies with the proportions of nitrogen they contain as an impurity with the methane which is the main constituent; (*b*) the self-induction of the circuit is of prime importance in determining whether the break-flash can ignite an explosive mixture, and below about 0·03 henry the current required for ignition rapidly increases; and (*c*) an increase in the voltage from 10 to 30 volts does not materially alter the amount of current required to ignite a particular mixture, while, on the other hand, an increase in the current of 0·01 ampere is often sufficient to determine the ignition of a mixture.

The solution of the problem then is to reduce the self-induction of the magnet coils of the bell so as to render the intensity of the spark harmless in any mixture, and experiments were carried out with signal bells of different types with perfectly satisfactory results.

(*To be continued.*)

WIRELESS CALL DEVICES.

By L. B. TURNER, M.A., A.M.I.E.E.

(*Abstract of paper read before the* Institution of Post Office Electrical Engineers, London Centre).

In submarine telegraphy moderate power is transmitted, and much less, but still moderate, power is received. In telephony the power transmitted is ordinarily a small fraction of a watt, and only about one ten-thousandth of this may be received at the other end. In wireless telegraphy, unhampered by the limitation of input imposed by the microphone, and with a receiver of extraordinary sensitiveness, the ratio between the power received and the power transmitted may reach a degree of smallness quite unapproached in telephony. The following table shows, in a rough illustrative fashion, the orders of magnitude of the power transmitted and received in the several systems named :—

	Watts transmitted.	Watts received.	Ratio.
Submarine telegraph	1	10^{-8}	10^{-8}
Telephone	10^{-2}	10^{-6}	10^{-4}
Wireless telegraph	10^{-5}	10^{-8}	10^{-13}

The primary difficulty in devising an effective wireless-call apparatus is the extreme smallness of the power available; for, obviously, if the device is to be of the fullest service, the calling range must be as great as the signalling range.

A secondary difficulty is the avoidance of false calls, that is, calls actuated by foreign wireless stations discharging their ordinary traffic, or by atmospherics.

The problem is, therefore, in the main, to provide apparatus capable of responding noisily to such stimulus as may be got from an antenna fed with about one-hundredth of a microwatt, but which will not respond to stray disturbances.

Excluding the coherer from consideration, no wireless call apparatus has yet, so far as I am aware, been put into commercial operation.

The available energy is so small, that no relay of the make-and-break type with solid metallic local-circuit contacts could be constructed to give reliable service. The ingenious jet relay of Dr. A. Orling, already employed in submarine cable telegraphy, could, however, be used. In this instrument a coil is carried by vertical phosphor-bronze suspensions in the field of a powerful magnet, as in an ordinary D'Arsonval galvanometer. A fine quartz fibre, called the deflector, is stretched as a stiff radial arm attached to the coil. Above this fibre is a vertical glass jet, through the fine orifice of which protrudes a second quartz fibre bearing with a light lateral pressure on the horizontal fibre. A fine stream of acidulated water runs through the orifice of the jet and along the vertical quartz fibre. At the end of the vertical fibre, a little below the deflector, the stream either just hits or just misses one of two platinum plates, thereby either making or not making contact between it and an electrode immersed in the column of acid. A very slight motion of the deflector carried by the coil produces a much magnified displacement of the stream of liquid where it passes the electrode. I have seen such an instrument relay hand-speed signals of .37 microampere. The coil had a resistance of 500 ohms, so that this corresponds to a steady-current power of 7×10^{-11} watt.

Of the amplifier type there is a diversity of patterns. Probably the most familiar is Mr. S. G. Brown's telephone amplifier, capable of responding to currents of telephonic frequency.

Another highly sensitive amplifier is that due to Mr. E. S. Heurtley. This device depends on the change of resistance produced in hot, thin platinum wire, when it is slightly displaced across the edge of a blast of cold air.

When the amplifier is used for submarine telegraphy, good readable slip may be obtained at slow speed with a deflecting power of 6×10^{-10} watt in the coil. The power in the siphon recorder would then be about 5×10^{-7} watt, giving a multiplication of nearly 1,000.

In all the relays above mentioned the change in the local current is effected by the displacement of some comparatively massive body. In the kathode-ray amplifier of Von Lieben and Reiss the moving body is molecular, or, rather, corpuscular.*

The kathode-ray amplifier is likely to play a very important rôle in the future. It can deal with the smallest powers, introduces no perceptible distortion, and is available for amplifying fluctuations of any rapidity up to the frequencies used in wireless telegraphy. The Marconi Company have developed a modified form of the Lieben-Reiss amplifier, which plays an important part in their high-speed reception.

With the exception of the last, the foregoing relays or amplifiers have been D.C. or low frequency instruments, suitable for use after the high-frequency current has been rectified by a crystal or other detector.

Any one of these extra-sensitive relaying instruments might replace the telephone of an ordinary receiver, and so, in conjunction with other instruments, convert signals which would have been a faint buzzing in the telephone into the ringing of a bell. But whereas the listening operator attends only to a message preceded by a certain sequence of dots and dashes, his call signal, the bell would not exercise this discrimination. It is necessary, therefore, to arrange that a signal of some special character shall be used for calling, and that the device shall respond only to signals of this character. Although much may be effected by the ordinary tuning methods, a call device requires a greater selectivity than can be thus obtained.

A simple form of call signal is a long dash, and the receiver may be constructed so that it will respond only to a dash of not less than a certain minimum duration, which would, of course, be chosen longer than any dash likely to be made in transmitting messages. This principle has been utilised in the P.O., and could be applied to any of the quick-acting relays.

The musical-note transmitter, now so widely used, introduces the possibility of a second line of defence against interference, by making use of musical resonance. The antenna and coupled circuits are already tuned to the high frequency, say 10^5 to 10^6 periods per second, giving selection by wave-length syntony; and with a musical note the telephone or other apparatus may be tuned to the spark-frequency, say, 200 to 1,000 periods per second, giving selection by note syntony. The Telefunken amplifier is constructed to make use of note syntony. This instrument consists of a bank of microphonic contact relays, each similar in arrangement to the Brown amplifier with granule contacts. But whereas in the Brown amplifier the electro-mechanical connection between the armature and the circuit energising the magnets is as close as possible, and the armature has a natural frequency greatly exceeding the frequency of the currents to be amplified, in the Telefunken amplifier the armatures are relatively loosely related to the energising circuits, and the natural frequency of each armature is mechanically adjusted to be equal to the spark-frequency (500 periods per second). It is claimed that with a bank of three such tuned amplifiers in cascade very great magnification and selection can be obtained.

But whether the transmitter is a musical one or not, it is possible to effect a syntony somewhat analogous to note syntony by transmitting dashes at small regular intervals. A scheme for a distress call device, depending for its selectiveness on this principle, has been suggested by Mr. W. S. Peake in a recent patent specification.

The essential point of the device is that the vibration of an armature under a succession of impulses is built up gradually, as in all cases of resonance; that is, the effect of successive impulses is cumulative, as it designedly is not in a Brown amplifier, an oscillograph or a telephone used for speech. Peake employs a transmitter sending alternate dashes and spaces at a definite frequency (between 10 and 40 per second), and the armature of the receiver is mechanically tuned to this frequency, as in the Telefunken amplifier. When the amplitude has grown sufficiently, contact is made and a bell rings.

The arrangement is mainly of interest in that it provides a probably adequate selectiveness by the use of a quite practicable apparatus which could be added to an existing ordinary station. It embodies nothing new in principle, for the resonance relay is a well-known device; it was used in an attempt to provide a call device on the Preece induction telegraph connecting the Skerries with the mainland. I think it would fail on the score of insensitiveness.

One further potential wireless call apparatus is the Marconi Company's quite recently developed device for the remote control of fog-signalling apparatus. This constitutes, I think, the nearest approach that has been made to a practical call device which can be left to itself. The result has been achieved by reverting to the coherer, but in a specially reliable, and consequently insensitive, condition. The coherer controls a relay of conventional type, whose local circuit energises the magnets acting upon a pendulum of balance-wheel form. Dashes are sent at equal intervals (automatically) from the calling station, and at each dash the coherer coheres, the relay tongue flicks over, and an impulse is given to the balance-wheel. The balance wheel has been mechanically tuned to the frequency of the transmitted dashes, which are of the order of two per second; its amplitude, therefore, grows under the repeated stimuli, until a fork carried by the wheel dips into mercury-cups, and the fog-gun is thereby switched on or off. Apart from malicious interference the selectivity here is as perfect as could be desired, for however strongly an interfering signal affects the coherer, its effect on the balance-wheel is the same. There are various carefully thought-out detail refinements in this apparatus, and tests appear to have shown that it may be left absolutely unattended over long periods. Its unsuitability for P.O. work lies chiefly in its insensitivity.

At the P.O. wireless stations for ship service a continuous watch is kept day and night; the operator on duty wears the telephone constantly, and is always ready for a message addressed to him. A call device, howsoever devoid of limitations and objectionable features, would be of little service at one of these stations. There is, however, a considerable demand for wireless communication between the mainland and small outlying islands, or between the separate islands of a group. The department already has ten stations in use for this sort of communication, and with a suitable call device, or even without, these short-range land-to-land stations will probably become quite numerous. At the existing stations the practice is for one of the pair to call the other once an hour, or at other defined intervals; and seeing that the operator usually has also to attend to the land line, sell stamps, pay out old-age pensions, and perform other functions, precise punctuality cannot be expected. Consequently, such a method of working causes a good deal of annoyance and wastes much time. Fur-

* This device was fully described in the Electrical Review of May 1st, 1914.—Eds.

thermore, in some instances that have arisen, it is desired, for life-saving purposes, to have the telegraph available day and night. For this class of work there is pressing and immediate need of a wireless call device.

Owing to the short range—maybe ten miles or so—over which these stations are required to work, difficulties from interference from ships are in many cases not very great. There is, however, one condition which must be satisfied in a call apparatus for this work, and it is a hard one to meet; the instruments must require no skilled attention from day to day.

The apparatus shown has been constructed with a view to meeting this quite specialised want of the department.

The principal features of the device are as follows:—At frequent pre-arranged times—four times an hour in this apparatus—the clock switches in a crystal receiver of ordinary character, except that an extremely sensitive D'Arsonval galvanometer replaces the usual telephone. The receiver remains in circuit for a brief period only—about ¼-minute in this apparatus. If the key of the calling station is held depressed throughout this period, the needle of the galvanometer is deflected into position between the jaws of a hit-or-miss device actuated by a local current. When the needle is in its undeflected position, the closing of the jaws is without effect, for the jaws are slightly staggered, like those of a bulldog; but if the needle is in place between them, it is gripped by the jaws, a local circuit is closed, a continuous-ringing bell relay actuated, and the bell rings. Any atmospherics or signals, whether of the appropriate wave-length or any other, and of whatever strength, are without effect unless they occur during the brief period of activity of the receiver. The probability of damage to crystals and of false calls is, therefore, reduced by the agency of the clock-switch in the ratio of 15 minutes to one-third minute, *i.e.*, 120 times, whereas the delay to a telegram caused by this system of working cannot exceed ¼ hour.

Despite this safeguard, it must happen that the crystal will be "knocked off," in the wireless jargon, by atmospherics some time or other. A second line of defence is, therefore, prepared by the provision of two crystal detectors, which are used alternately. An instrument called, for lack of a better name, the mercury toppler, in addition to other duties, switches over after each period, so that the other crystal detector shall come into use at the next period. If, therefore, one of the detectors has been knocked off and a call is, in consequence, unsuccessful at one period, it can still be made a quarter of an hour later. Communication then being established, the failure would be reported to the defective station, and the faulty detector be replaced by the spare provided.

Except during the few seconds of activity, the detector is disconnected from the receiving circuit and short-circuited on itself, and is immune from any electrical damage.

The galvanometer is shunted so as to be dead-beat; when unshunted it has a period of about 15 seconds. As now set, the minimum deflection to make a call is about 5°, and this is produced by a current of $40\cdot^{1}$ microampere; $20\cdot^{1}$ microampere is considered a safe working current. The galvanometer is not harmfully affected by rapid vibrations.

In the absence of a suitable quick-acting relay of extreme sensitiveness, it is necessary to accumulate the energy of the received signal over some considerable time before a sufficiently energetic response can be produced. In the call device dealt with in the last section, the accumulation takes place during the several seconds in which a slowly moving galvanometer coil is gradually deflected. It is also possible to accumulate the energy in an oscillating body, provided that the signal is intermittent and synchronises with the oscillation. This method of working enjoys a certain selectiveness which is not inherent in the other; it is the method adopted in the Peake device.

Whether the accumulator of energy be an oscillatory one or not, it must be capable of continuing the accumulation over a sufficiently long period.

In the second call device exhibited, Peake's reed vibrating at (say) 25 periods per second is replaced by the coil of a galvanometer oscillating at $10\cdot^{1}$ period per second, *i.e.*, 250 times slower. Consequently, if the decrements of the coil and reed were equal, signals would continue to add energy to the coil 250 times as long as to the reed. The gain in ability to accumulate energy from the signal is more or less proportional to the lengthening of the period of the oscillating system.

In this second call device, the galvanometer coil takes the place of the telephone in an ordinary receiver, and a swing is gradually built up from the sending station by keeping the key depressed during every alternate five seconds. Since the detector is always in circuit, a Fleming valve is used instead of a crystal, as the valve, though less efficient, is not liable to be knocked off by atmospherics.

The moving coil is cast with wax into smooth cylindrical form to reduce air friction. It has a resistance of nearly 6,000 ohms; is suspended by a stout phosphor-bronze strip, and has a radial arm or tongue of fine platinum wire free to move between two fixed vertical platinum wires. The galvanometer constitutes a microwatt relay. The moment of inertia of the moving system (viz., 9.8 gm.−cm.²) has been adjusted to give a period of just 10 seconds.

The tongue is kept in mid-position between the side-contacts by the torque of the suspension balancing the torque due to the polarising current of the valve. This polarising current, which may be 10 or 20 times the current due to the signal, is largely affected by variation of the filament current; and as the filament takes about half an ampere, the current in it must appreciably fall as the battery discharges. This might be a serious difficulty, but by use of the circuits shown in fig. 1, a fall in filament current is made to compensate for itself by producing a suitable rise in the polarising P.D. This

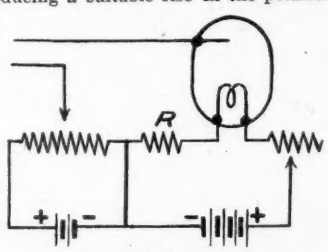

FIG. 1.

arrangement has proved remarkably successful. A variation of ± 10 per cent. in the filament current produces no perceptible deflection of the pointer; whereas without the balancing circuits + 10 per cent. rings the bell and − 10 per cent. nearly does so.

This call device possesses the merits of simplicity and robustness, and the present makeshift set will make a call with a signal of 0.063 microampere in about 2½ minutes, or with .14 microampere in about 1¼ minutes. The sensitivity could, I feel sure, be considerably improved. The objection to this device for P.O. short-range stations is that the valve has a continuous consumption of some 4 watts, which is a serious matter when dry cells supply the power. This objection might be overcome, and greater sensitiveness obtained by the use of a crystal detector, if a non-earthed antenna sufficiently free from atmospherics were employed.

RÖNTGEN SOCIETY.

AT the meeting of the Röntgen Society on June 1st, the principal business was a discussion on the protection of the X-ray worker from the evil effects of the radiations with which he has to deal. The subject derived special importance, said the President, Sir A. P. Gould, in view of the extraordinary number of X-ray outfits which were being installed in military hospitals, both at home and abroad. These were often placed in charge of men having only scanty experience, who were called upon to work under circumstances of very great pressure, and the attention of manufacturers of X-ray apparatus and others should be called to the possibility of grave perils arising as a result of insufficiently protected equipments. Mr. Sidney Russ, D.Sc., said that he had been comparing the protective materials supplied with the installations of three manufacturers, who should be denominated X, Y, and Z. The lead rubber placed between the operator and the tube varied very greatly in different samples, as, for instance:—

	Thickness of lead rubber in mm.	Percentage of X-ray energy transmitted.
X	2·2	1·4
Y	1·54	4·9
„	3·07	1·1
Z	1·25	5·0
„	2·5	1·0
„	3·75	0·4
„	5·8	0·1

Lead glass, which was also used largely as a protective material, varied in a still more perplexing fashion, the absorptive power for the dangerous radiations bearing no relation to the thickness of the glass, but only to its density. Here, again, three manufacturers submitted samples, with the following result:—

	Thickness of lead glass in mm.	Percentage of X-ray energy transmitted.
X	3·63	2·9
Y	3·87	5·5
„	5·0	4·1
Z	3·25	4·3
„	3·65	3·4

As a dream of the future, Dr. Russ thought that before the radiologist began his work the atmosphere would be examined for ionised particles, just as drinking water had to be examined and sterilised. Mr. J. H. Gardiner, F.C.S., urged, with a view to guarding against secondary radiations, that X-ray tubes should be enclosed completely in a good thick case of thoroughly efficient and heavy lead glass. The protection of the tube in the plane of the anticathode was not sufficient, owing to the vagrant secondary radiations. The following resolution was carried: "That in view of the recent large increase in the number of X-ray installations, this Society considers it a matter of the greatest importance that the personal safety of the operators conducting the X-ray examinations should be secured by the universal adoption of stringent rules, and that the Council of the Society be requested to meet at an early date and take steps to secure this end."

At the annual business meeting, Mr. J. H. Gardiner was elected President, and Mr. W. Duddell a vice-president.

A GLASGOW HOSPITAL.

THE Royal Hospital for Sick Children, Glasgow, which was opened by the King and Queen in July last year, is a large establishment equipped on the most modern lines, and possesses an exceptionally complete installation of electrical appliances. Electricity is supplied by the Glasgow Corporation Electricity Department, through duplicate cables to each of two main switchboards in the basement of the building; a duplicate supply is furnished to the operating theatre, under local control.

Artificial illumination is provided for by nearly 2,000 metallic-filament electric lamps. Thirteen lifts and the whole of the laundry, kitchen and other machinery are operated by electric motors, of which there are, in all, upwards of 40. Ventilation is effected entirely by electrically-driven fans. There is an extensive automatic intercommunication telephone system having 30 stations, in addition to the Post Office instruments, of which there are five with a central exchange.

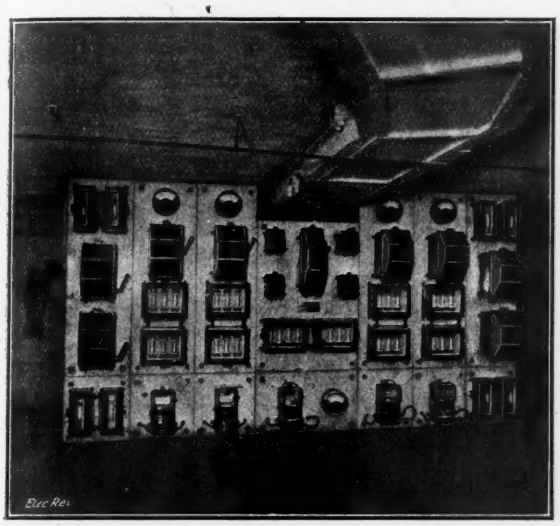

FIG. 1.—SWITCHBOARD IN MAIN BUILDING, SHOWING CABLE-CARRYING STRUCTURE.

The clocks throughout, about 30 in number, are electrically operated and controlled, as also are the several bell systems.

In addition to these ordinary utilitarian services there are the very extensive and varied uses of electricity in electro-surgery, Röntgen ray, high-frequency, and other special apparatus too numerous to mention in detail.

In the wards general illumination is obtained by central pendants, so shaded that the actual lamps are screened from the bed positions. One of these pendants, in each ward, is of the inverted type to serve as a night light. By the bedsides, brackets and special portable hand-lamps are provided for local use.

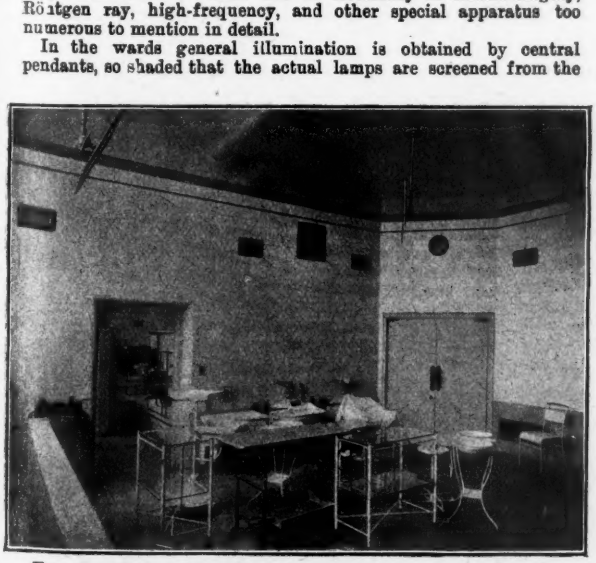

FIG. 2.—ONE OF THE OPERATING THEATRES, WITH TABLE ILLUMINATED BY REFLECTION.

The corridors, passages and stairways have ceiling fittings in the form of an inverted cone, on the bottom of which the lamp is fitted. These cones are treated as a part of the ceiling and painted to match.

In the operating theatres an external source of light is employed for the operating tables. Arc lamp projectors are installed in an adjoining chamber, the beam of light being projected through a glazed aperture in the wall and on to the operating table by means of adjustable mirrors.

For the general illumination of the operating theatres special sunk fittings with flush glazed bronze covers have been employed. These frames fit into position by their own weight, and have no fixing studs or screws, but are nevertheless water-tight. The arrngements generally in the operating theatres are such that the walls may be washed down without risk or damage to any portion of the electrical fitments.

The whole of the internal electric light fittings are of plain smooth design to avoid so far as possible dust collection, and to render them easily cleaned.

The laundry equipment includes washing machines, hydro-extractors, ironing and finishing machines, and a large drying room above, served by an electric hoist. All the machines are electrically driven, some having the motors direct coupled, and others being driven by belts.

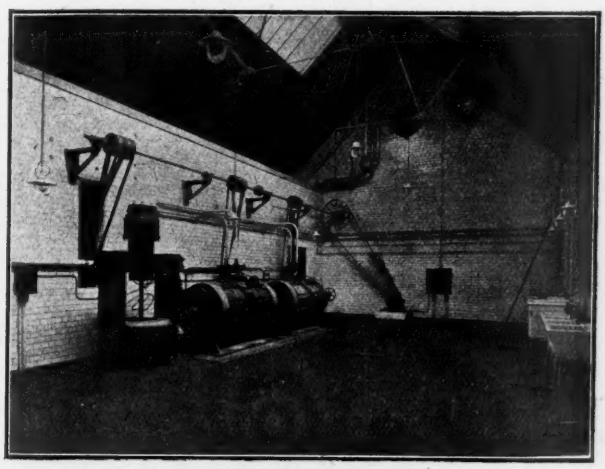

FIG. 3.—WASHING HOUSE IN LAUNDRY.

We publish herewith some views of the plant, for which we are indebted to the consulting and advisory electrical engineers to the Board of Control, Messrs. James E. Sayers & Caldwell. The contractors for the electrical equipment generally were Messrs. Telford, Grier & MacKay; the electric clocks were supplied by the Magneta Time Co., Ltd.; the telephones by the Sterling Telephone and Electric Co., Ltd,; and the lifts by Messrs. Waygood-Otis, Ltd.

SCIENTIFIC AND TECHNICAL COMMISSIONERS.

BY W. POLLARD DIGBY, Lieut. R.E. (T.), A.M.I.E.E.

(*From the Journal of the* INSTITUTION OF ELECTRICAL ENGINEERS. *Abstract.*)

MILITARY victory *per se* is not the only duty before us; the military victory once attained, success in the ensuing commercial warfare must be the essential objective. The comparative incidence of the burden of taxation after the war will be heavier than anything we knew before Europe mobilised. Capital will be very scarce, and exports of capital in the form, say, of engineering machinery or railway plants to neutral markets will probably be on a greatly reduced scale.

The organisation of industry, particularly with reference to oversea markets, is as important as the organisation of the intelligence service of a field army, and the better the industrial organisation of any manufacturing nation, the sooner will be the recovery from the aftermath of the war.

External aids to trade have received consideration, but it is a very open question whether all that can be done, has been done. The Commercial Intelligence Branch of the Board of Trade is the medium of conveying a great deal of Consular information concerning prospective trade openings in the Colonies or in foreign countries. Trade Commissioners and Commercial Attachés have been appointed, and it is with no idea of belittling the useful work that they have done that the author urges the selection of an entirely new type of official representatives to perform the duties of Technical Commissioners.

Unless written by specialists, neither the reports of Commercial Attachés and Trade Commissioners, nor the Consular reports, can be reasonably expected to give details, say, of the successful types of competing foreign manufactures, the reasons of lower price, the reasons apart from price why British types are not successful, and the local conditions which may render typical British articles unsuitable. Such reports can only be adequately written by specially selected men situated in friendly countries, having behind them all the prestige of our diplomatic service. The men to be chosen for the duties must be of a high type. They must be recruited with as much care as the secretaries of our various

Embassies and Legations, but recruited differently. The modern side of a public school, and an engineering degree at Cambridge, Oxford, London, or Manchester, are by themselves wholly inadequate credentials for a Technical Commissionership. Industrial experience is as essential as the intervening years of sea service between leaving Osborne and a naval attachéship for officers in the Navy.

The Technical Commissioner should be a specialist. Specialists acquainted with the needs of distinct industries must naturally possess an all-round knowledge of those branches of applied science most closely related to their own special work, and should possess imagination. Much, very much more than is supposed, of German success in the past has been due to the possession of a scientific and commercial imagination. If we look back on the history of the evolution of any branch of science, or even of any piece of machinery, it is at once evident that at any stage the next advance might have been predicted by the intelligent putting-together of the then ascertained achievements and phenomena.

There must, therefore, be among the essential credentials of the technical commissioners evidence not only of practical experience and the power of succinct description, but of a logical imagination.

Visits of individual engineers abroad are directed mainly, if not entirely, to purchasing countries, not to competing manufacturing countries.

The author has yet to learn of an British firm maintaining an intelligence department in any foreign manufacturing city, concerned in no way with the sale of the firm's products, but with the sole duty of forwarding technical information to the firm's headquarters.

The technical commissioner must be essentially a worker; he must make long journeys from his headquarters, and on his return must give a great deal of attention to office work. His minutes will be lengthy and numerous. He will have to avoid giving too much of his time to the social side of life.

The professional status of a technical commissioner, say, in engineering, should be at least the equivalent of full membership of one or more of the institutions most closely concerned in his work, viz., the respective Institutions of Mechanical Engineers and of Electrical Engineers. Those concerned with mining machinery or metallurgical matters should belong, among other bodies, to the Institution of Mining and Metallurgy. The chemist, too, should possess equivalent qualifications. Before proceeding to take up his post, the newly appointed technical commissioner should have ample opportunity of conference with representatives of the industries concerned with his sphere of work, both as regards their selling and their technical departments and methods of manufacture. At stated intervals he should return to England to confer with those concerned in his work.

The technical commissioners should rank after, but be associated with, the present commercial attachés, assisting the latter by the preparation of the scientific and technical matter required for general reports. Prompt dissemination of the information, sometimes perhaps in the shape of secret and confidential publications, will of course be requisite.

An engineering commissioner for any particular branch of the industry would report on types of plant in use, study its operation, and send home recommendations thereon. He would join the engineering Institutions of the country in which his duties lay, attending annual meetings, congresses or conventions, and abstracting promptly important information in the technical papers.

It would be easy to multiply instances of possible useful activity, but any manufacturer knows the technical information which he would like to have, and which could be furnished by a technical commissioner of the right type.

We shall be indeed a short-sighted race, if, when military war again gives place to the commercial warfare waged by manufacturing countries for foodstuffs and luxuries, we do not strain every nerve to apply system to our methods. We must remember that the added burdens not only of direct taxation but of reduced numbers of food-getters will render commercial success more vital to our welfare than in the past. It is well within the bounds of feasibility that German industrialism may make a rapid recovery. Her factories and equipment are uninjured. Only raw materials and markets are needed for industrial production to be resumed.

Just as the important, and in some respects almost dominating position, which Germany held in the neutral markets of the world before the war was in part due to the thorough and systematic methods of her commercial engineering departments, so her innate genius of organisation and co-ordination, her capability of concentration of purpose, and her logical industrial imagination, will guide and steady her progress towards a recovery of her previous position. To this she will be relentlessly spurred by the grimmest of necessities, that of food earning.

Mere exhibitions of German articles in London, with particulars of the wholesale and retail prices, though good in their way, will not suffice. We need representatives with technical experience and foresight studying conditions in the markets which we seek to supply. We can either leave this to sporadic industrial enterprise (generally an unsatisfactory quality, and undoubtedly expensive and inefficient), or make it a matter of national organisation, and as definite a branch of official activity as the duties of the Development Commissioners.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Roto-Drum Pumps.

The WORTHINGTON PUMP CO., LTD., of India House, Kingsway W.C., have developed a rotary dry vacuum pump or blower suitabl for direct coupling to an electric motor, as shown in fig. 1. Th pump operates on the familiar principle of the rotating eccentric drum fitted with sliding steel plates which act as pistons; the plates do not rub on the inside of the cylinder, but are carried by hardened and ground steel running rings, which "float," so that no rubbing friction is set up. The shaft is carried on ball bearings, and all friction is reduced to the minimum. The casing is provided with a water jacket. The pump illustrated is capable of handling 20,000 cb. ft. of free air per hour at 700 R.P.M., and is very compact for the output. Ten sizes are made.

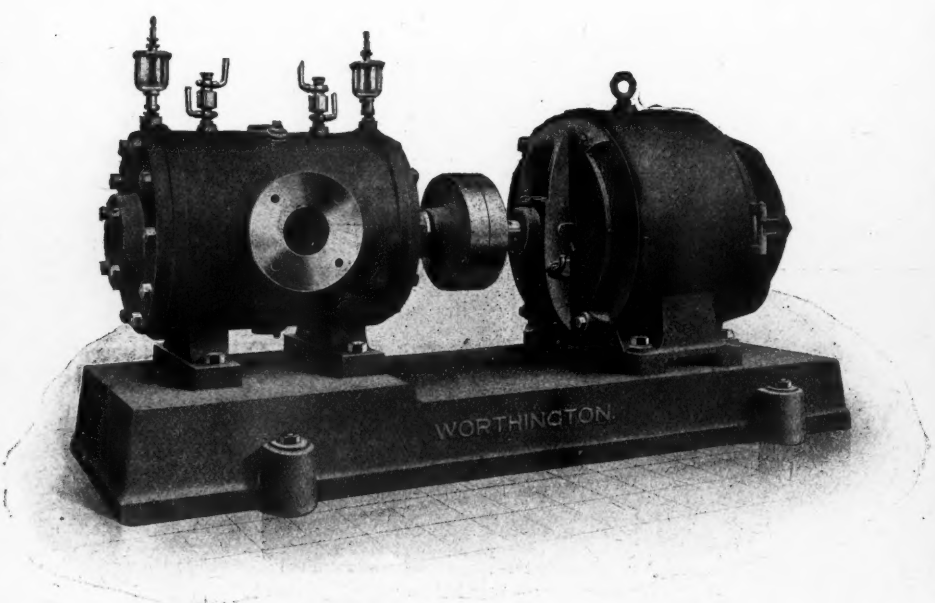

FIG. 1.—WORTHINGTON ROTO-DRUM PUMP COUPLED TO MOTOR.

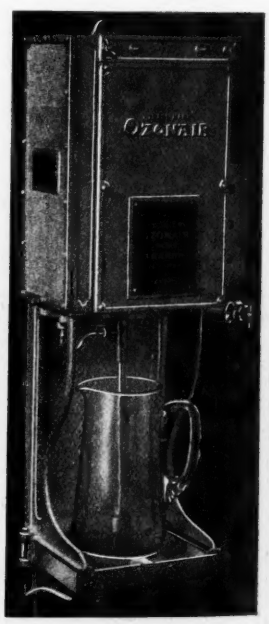

FIG. 2.—OZONAIR DOMESTIC WATER STERILISER.

Ozonair Water Steriliser.

MESSRS. OZONAIR, LTD., of 96, Victoria Street, S.W., have devised a water steriliser of small dimensions for domestic use, which we illustrate in fig. 2. It consists of a metal frame which is fixed to the wall, and comprises a case containing the ozone-producing apparatus above a bracket and swivelling tray to carry the receptacle for the sterilised water. The apparatus is quite

automatic in action; on placing the jug in position and turning on the water tap, which is provided as part of the device, the ozone generator is set in operation. The steriliser is made for any type of supply and any voltage, and works on any water pressure from 12 to 50 lb. per sq. in.; the metal work is neatly finished in aluminium. Closing the tap stops the generator. The advantages of ozone for sterilisation are well known to our readers, and the system has been used for public supply abroad for many years, but a small British-made domestic plant has not hitherto been available.

"Witton" Multiple Switch Starters.

The GENERAL ELECTRIC CO., LTD., of Witton, have recently supplied a number of multiple switch starters, comprising a mistake-proof starting switch cutting out sections of the resistance in the ordinary way and interlocked electrically with a circuit breaker.

In starting up a motor controlled by a "Witton" multiple switch starter, the circuit breaker is first closed, and the switch cutting out the first step in the resistance is then inserted. But

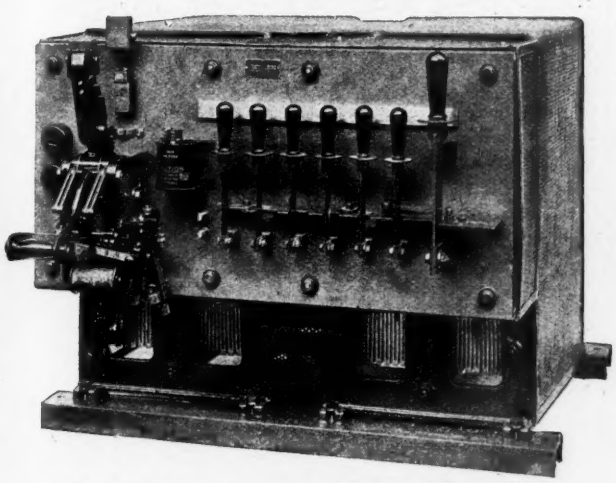

FIG. 3.—"WITTON" 100-H.P. MULTIPLE-SWITCH STARTER.

should an attempt be made to insert either the switch that short circuits the resistance or an intermediate switch on the starter, the attempt is frustrated by an interlocking bar. This bar is automatically moved along by the switches as they successively close, and precludes the closing of any of the other switches out of their proper sequence. Further, should the circuit breaker trip due to an overload on the motor and an attempt be made to replace it—which would mean short-circuiting the supply—a special trip

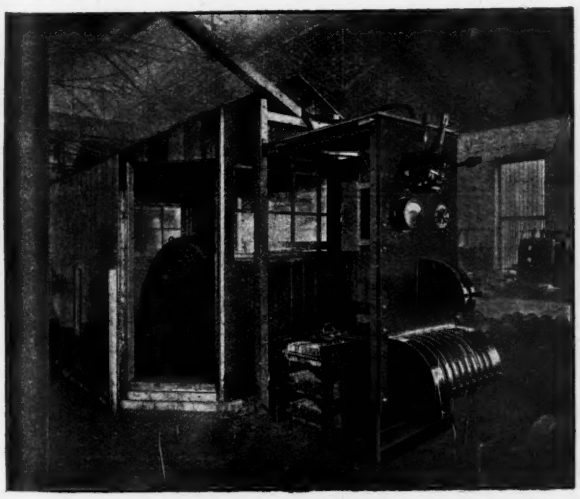

FIG. 4.—MULTIPLE-SWITCH STARTER FOR ROLLING-MILL MOTOR.

coil on the circuit breaker is energised through contacts which are shorted when any or all the switches on the starter are closed. The action of this trip coil locks the circuit breaker mechanism and prevents the breaker being closed.

The accompanying fig. 3 shows a "Witton" multiple switch starter for controlling a 100-H.P. motor, together with the necessary resistance and circuit breaker, while a view of a similar device controlling a 300-H.P. "Witton" rolling-mill motor is shown in fig. 4. In the latter case it will be observed that the switches are provided with a suitable cover.

Renewing Tungsten Lamps.

There is a good deal more useful material in a burnt-out tungsten lamp than in a carbon-filament lamp, and naturally attempts to make use of it have not been wanting. Mr. Hedley Field, of the ALLIES ELECTRIC LAMP CO., LTD., Montgomery Street, Hammersmith, W., has just shown us a sample of such a lamp, in which the filament has been renewed, without using any fresh material other than the new filament. In this company's process, the bulb is cut off at the shoulder, the glass is cleaned, and the new filament is mounted; a glass tube is then fused on to the pip of the bulb, the latter is joined at the original cut, and the lamp is exhausted and sealed in the usual way. The company has been at work for about a year, and has applied the process to lamps of all sizes, from 8 to 400 C.P., for voltages up to 250 volts; the same efficiency is claimed as for new lamps, and the life of a renewed lamp is guaranteed to be not less than 1,000 hours. The appearance of the lamp is practically unchanged, and the operation can be repeated several times.

WAR ITEMS.

Openings in Italy.—From the British Chamber of Commerce for Italy at Genoa we have received further lists of openings for British articles in Italian markets, from which we extract the following. Some of these firms formerly did business with German and Austrian houses, and now seek British connections:—

No. 680. Agent at Turin wishes to hear from manufacturers of machine tools. T.A.R.
No. 682. Agent in North Italy would take up agencies for scientific instruments. E.G.B.
No. 684. Electrotechnical engineer at Turin would represent British manufacturer of electric material and apparatus. T.S.G.
No. 686. Agent at Naples would represent manufacturers or shippers of steel, tools, machinery. N.G.B.
No. 696. Agent at Genoa representing British firms in other similar lines, has openings for electric lamps and apparatus. G.C.D.O.
No. 712. Firm at Florence would sell on commission in Tuscany, or merchant, machinery. F.O.G.
No. 718. Agent at Turin inquires for leather belting. T.G.B.
No. 736. Engineer at Turin has openings for iron and steel, rain-water pipes, water-meters, steel tubes, anti-rust paint. T.P.F.
No. 729.—Rome agent would take up electric lamps. R.O.B.
No. 738. Agent at Genoa would sell on commission or merchant—copper, bronze, brass, zinc, aluminium, nickel, iron in pigs, electrical sheets of steel, for all Italy. G.E.A.R.
No. 739. Commission agent at Genoa has openings for anchors, warping machines, steering gear, thermotanks, steam and electric winches. B.
No. 764. Engineer at Rome wishes to represent important manufacturer of electrical material, motors, pumps, lifting machinery. R.A.F.
No. 775. Commission agent at Genoa wishes to hear from manufacturer of electric pianos. G.F.D.B.
No. 782. Commission agent at Bologna wishes to represent manufacturer of machinery for paper mills, spinning mills, wool, cotton, linen, hemp, jute, workshops, files, linen and cotton yarns. B.C.F.
No. 790. Manufacturers at Bordighera would take up mechanical and electrical specialities. B.W.B.

"Munitions—More Munitions!" but "Keep the Atmosphere Pure."—Messrs. Connolly Bros., Blackley, Manchester, were summoned at Manchester, on June 2nd, for permitting a black smoke nuisance at their works.—Mr. Pickford (for the Corporation) said the magistrates had previously made an order for abatement on the defendants so long ago as December, 1900, and the nuisance was still existent.—Inspector Chisholm said that on April 20th he took observations of defendants' chimney, and in 30 minutes black smoke was emitted for a total period of 4½ minutes. When he saw the fireman the latter said he had been as careful as possible, and the emissions must be due to the bad coal they were getting.—Mr. Connolly said that when he was before the Court on April 7th last he read a letter which his firm had received from Lord Kitchener, showing that they were really working seven days a week to get out urgent War Office orders. They were still working on munitions and were at their wits' end to turn out the goods fast enough. He also read a letter from a colliery company, stating that for the present the firm would have to be satisfied with any kind of coal they could send, as they were crowded out with Government work. The works had been completely changed from steam to electric driving. Electrical machinery had been installed at a cost of £750, and an eighth motor was put in last week. He suggested that that showed that the firm were striving to meet the Corporation's requirements. They were taking all their power from the Corporation, and they had also had a complete transformer house erected for them by the Corporation. He thought the present summons might be withdrawn, and said he did not see how they could do any more than they had done to try to abate the smoke nuisance. They were working night and day on war contracts, and had even had to employ men 75 years of age to help them to get the work out. A fine of 30s. was imposed, the Bench intimating that whilst they fully appreciated the difficulties of the firm they had to maintain the purity of the atmosphere as far as possible. Mr. Connolly remarked that it was hard lines that the firm should be fined again.

A Pocket Lamp Battery Syndicate.—The use of pocket electric lamps in Germany has assumed great importance among the rank and file of the army, and the production of batteries in particular has reached an exceptionally high level in recent months. A short time ago the battery makers were brought together in the form of a central organisation for war deliveries, and this has now been followed by the constitution of a syndicate of pocket-lamp battery makers at Charlottenburg, Berlin.

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Anglo-Belgian Electrical Co-operation. — Writing with regard to M. R. Steylaers's paper on this subject, M. Nouet, Editor of our esteemed contemporary *La Lumière Électrique*, points out that several small errors have occurred in connection with the names and addresses of certain French firms: The Société Française d'Electricité A.E.G., 72, Rue d'Amsterdam, Paris, which was sequestrated (*mise sous séquestre*) on November 24th, 1914, included in its administrative council M. Thurnauer (not Thurnauw), ex-manager of the Thomson-Houston Co., from which he has recently resigned. The address of the Société Industrielle d'Energie Electrique is 60 (not 30) Rue Caumartin, and M. Cohen (not Cahen) is a member of the administrative council of this company, as well as of the Socié é d'Electricité de Varsovie and of the Socié é Continentale de Traction et d'Eclairage. Otherwise our *confrère* finds the article interesting and accurate. We are much indebted to him for his kind assistance.

Russia.—A firm at Ekaterinburg, who formerly represented German concerns, desire to get into touch with United Kingdom manufacturers of locomobiles, internal combustion engines, and electric lamps. "Correspondence with this firm should preferably be in Russian, and, failing this, French is the only other language in which they would be prepared to correspond." Communications in this connection should be addressed to the British Vice-Consulate, Ekaterinburg.

An agent in Warsaw wishes to secure the agencies of United Kingdom manufacturers of electric lamps and wire.

Inquiry is made for the names of United Kingdom manufacturers of electric lamps and fittings, and carbons for arc lamps.

A firm desires to hear from United Kingdom manufacturers and exporters of engineering supplies for factories and railways.

A firm wishes to get into touch with United Kingdom manufacturers of electric power plant, appliances for teaching physics in schools, and lifts.

Manufacturers, &c., of the goods mentioned should apply, in the first instance, to the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C., for the names and addresses of the respective inquirers. Further communications regarding the inquiries should be addressed to the British Consulate, Warsaw.—*Board of Trade Journal.*

Commandeering Spelter.—According to the *Times*, the Munitions Committee contemplates issuing instructions to commandeer all spelter other than that being used for making cartridge metal, and prohibiting the use of spelter for galvanising sheets and wire, other than that for Government purposes. As a result of this no quotation for the metal was given by the Metal Exchange on Monday. The above action has become necessary owing to the difficulty of obtaining supplies of the metal, which are now obtained almost entirely from the United States. In normal times the United Kingdom's chief sources of supply are Belgium and Germany, which between them provide over one-third of the world's production. Since the war began Germany has prohibited the export of the metal. The last quotation for American spelter in London was £97 a ton, which compared with £22 before the outbreak of hostilities.

Australia and Enemy Goods.—The *Sydney Morning Herald* reports that on April 19th the Prime Minister, Mr. Fisher, received a deputation representing the Associated Chambers of Manufactures of the Commonwealth. It was asked that a 25 per cent. surcharge should be imposed on enemy goods for 10 years after the war. Mr. Fisher pointed out that when peace was declared there would be no enemy goods. It was then urged that the Commonwealth should bring in a three-schedule tariff on Canadian lines. This would provide for preference to British goods, a lesser preference to most favoured nations, and an ordinary tariff for enemy goods. The Prime Minister indicated that already considerable preference was given to British goods. Under the new tariff he promised that the matter would receive full consideration by himself and the Cabinet.

Re Custodis, Ltd.—In the House of Commons, on Tuesday, Mr. Runciman replied to questions with reference to Custodis, Ltd., and the Alphons Custodis Chimney Construction Co. He said, according to the *Times* report, that both companies were incorporated in this country, and therefore entitled to carry on business here, but last October an inspector of the latter company was appointed by the Board of Trade, in order that the Board of Trade could be satisfied that it was not trading with the enemy. Whatever guarantees had been given by the company to others as to no German capital being involved, he must be guided by the register of shareholders. It was an English company, with a majority of shares held by Germans—that was why an inspector was appointed.

Petrograd Electricity: Hitch in Procedure.—According to the *Novoe Vremya*, the Petrograd Town Council having decided to buy out the three electrical concession concerns, namely, the 1886 Company, the Electrical Equipment Co. (formerly Helios), and the Belgian Co., the Governor of the town has protested. The administrative body finds that the decision to purchase took place in contravention of the statutes of the town government. Specifically, the contravention consists in ignoring the regulation that all important questions affecting the town's economy may only be decided with a minimum attendance of 81, and with a majority consisting of two-thirds at least. The Governor protests that on the occasion in question the required majority was not present.

To Ourselves from "The Front."—A correspondent who is somewhere with the Forces (it is believed at the Dardanelles) writes home under date May 20th to a friend as follows:—"Next time the ELECTRICAL REVIEW man calls tell him that it reaches us every mail, and is read by a wide circle of engineers from every firm of any size in Britain. It always recalls your kindly forethought in arranging for it to be sent."

We are delighted to receive such messages as this from readers who are "doing their bit." We shall look for (may we soon receive) a letter from the writer from an address in Constantinople!

Anchor Volunteers.—About 80 men employed at the Anchor Cable Works, Leigh, Lancashire, who are engaged on Government work, last week joined the Leigh Athletes Volunteer Force.

War Munitions.—In the House of Commons, on Tuesday, it was stated that the approximate number of firms in the United Kingdom who had offered to manufacture munitions of war, but had not received direct orders from the War Office, was 300. Of these over 50 were engaged as sub-contractors. A question was was asked as to whether the Chancellor of the Exchequer would give the names of firms who were being subsidised or guaranteed by the Government for the extension of their factories or the erection of new factories. Mr. McKenna, in reply, doubted whether it would be in the public interest to give the particulars asked for at the present moment.

Personal.—Mr. Percy Taylor, assistant electrical engineer to the Darwen Corporation, who recently joined the mechanical transport service, has been appointed mechanical staff sergeant, and is in charge of a convoy of cars in South-East England.

Mr. Wilfred Pearson, son of Mr. J. Pearson, of the Altrincham Electric Supply, Ltd, till recently with the 5th Cavalry Reserve Scots Greys at York, has been gazetted second-lieutenant and appointed to the East Yorkshire Regiment now at Harrogate. Mr. Herbert Pearson, his brother, is with the King's (Liverpool) Regiment at Salisbury.

Mr. A. W. Empson, A.M.I.E.E., A.M.I.Mech.E., F.C.S., who recently resigned his appointment as chief station engineer to La Compania de Electricidad de Marida, Yucatan (Mexico) in order to serve in the British Army during the war, has joined the Motor Machine Gun Section, and is now in training at Bisley Camp. His permanent address is 14, Scarcroft Hill, York.

Mr. E. W. Davey, electrician, of 17, St. Andrews Road, Exmouth, has joined the Royal Flying Corps for active service.

Mr. A. Greed (meter tester), and Mr. J. Brooke (of the clerks' staff), of the Dewsbury Corporation electricity department, have joined the Royal Engineers; and Mr. J. Passmore (shift engineer) has entered the Navy as electrical artificer.

Roll of Honour.—We regret to learn of the death from wounds (caused by a sniper's bullet) of Captain John Chapman, of the 1st 5th Leicestershire Territorial Regiment. At the outbreak of war he held the rank of Lieutenant, but was shortly afterwards promoted Captain, and left with the regiment for the Front some time back. The regiment has been doing excellent work in the trenches. Capt. Chapman was a "Brush" boy, having served his pupilage with the Brush Electrical Engineering Co., Ltd., afterwards serving in the works electricians' department, and latterly being attached to the company's London office. He was a young man of attractive personality and of great promise in his profession, and his death at the early age of 26 years will be regretted by all who knew him. His popularity in his native town of Loughborough—whence the remains were taken for burial—and the sincere regret of his fellow-townsmen, as well as of the military authorities, at his demise, was demonstrated on Wednesday last week, when the honours of a military funeral were accorded, preceded by a Church service at which representatives from all sides were present. The directors and staff of the Brush Co. have conveyed their expression of regret and condolence to the bereaved relatives.

On May 26th, a bursting shell caused the death of Private Frederick Vere Shanks, of the 1st-4th Battalion, King's Own Yorkshire Light Infantry. Private Shanks was employed in the electricity department of the Wakefield Corporation.

Rifleman G. Frith, of Peel Green, Eccles, who has died at a hospital in France from wounds received in action, was formerly employed by the British Westinghouse Electrical and Manufacturing Co., Ltd., Trafford Park. He was 20 years of age.

Intelligence has reached Torquay that Mr. C. Walker, of the Corporation electricity clerks' staff, has been killed in action; and that Mr. Harding, a stoker at the works, is reported missing from H.M.S. *Goliath*, recently sunk in the Dardanelles.

Lieutenant J. Lindsay Drummond, of the 1st Royal Scots Fusiliers, has arrived at Dumfries on sick furlough. The lieutenant, who was an engineer in one of Glasgow's electric power stations before the war, went out to the Front in December. He was badly wounded in both ankles at St. Eloi.

Corporal A. E. Irving, of the Yorkshire Regiment, who worked on the Burnley Tramways before the war, has been awarded the D.C.M. He displayed conspicuous gallantry at Neuve Chapelle on March 12th, when by throwing bombs on the enemy he caused them to evacuate the trenches and come under the fire of his comrades.

Gateshead Tramwaymen and Red Cross.—As a result of their King's Theatre Matinee and Town Hall concert on April 21st (Gateshead and District tramwaymen), an amount of £91 was handed over to Whinney House for Red Cross purposes.

Denmark.—A firm in Copenhagen desires to secure the agencies of United Kingdom Manufacturers of electrical specialities and novelties. Apply first to the Commercial Intelligence Branch of the Board of Trade, London, for the name, and subsequently address the British Legation, Copenhagen.

REVIEWS.

The Electric Furnace. Second Edition. By A. Stansfield, D.Sc. 1914. London: Hill Publishing Co. Price 17s. net.

The first edition of this book appeared in 1907, but since that time the science of electrometallurgy has made rapid progress, and, as a consequence, the present edition has been increased to more than twice its original size, and the whole text has been reset. The author states in his preface that all recent developments of importance have been included, but as the revision has occupied at least three years, it has been impossible to insert some of the most recent work on this subject. The purpose of the book has been to trace the evolution of the electric furnace from its simplest beginnings, and to set forth, as briefly as is consistent with clearness, the more important facts relating to theory and practice. There is no doubt that the author has achieved this object, and has presented a most interesting and instructive contribution to the literature of electrochemistry.

This volume covers not only the progress, but most of the essential features of the design and operation of electric furnaces, and should be of immense value to both the student and the manufacturer.

The first chapter is entirely historical, and gives a brief survey of the development of electric furnaces to date. The next four chapters deal with the classification, efficiency, construction and operation of electric furnaces. Chapter II describes the essential features and classification of the various types of furnaces. Each class is clearly described, and diagrammatically illustrated. Chapter III is devoted entirely to questions of efficiency and cost. The economic relations between electricity and fuel heat are fully described and discussed. Furnace construction and design are dealt with in detail in the next chapter, which constitutes one of the most important features of the book. The opening pages give an account of the different refractory materials in use for furnace lining. The thermal conductivity of furnace materials is considered from both the theoretical and the practical standpoint. A few pages are devoted to the radiation and convection of heat, as a preliminary to a detailed study of the various types of electric furnaces. The whole chapter is fully illustrated with diagrams, curves and tables, and is clearly elucidated by means of practical examples. Chapter V treats of the operation of electric furnaces. It opens with an account of the different forms in which electric power is supplied at the present time, and the methods of coupling the supply of energy to the furnaces. Heat production, power consumption, regulation and control in furnace practice are all discussed in a clear and concise manner.

The next chapter opens the section treating of the various uses of electric furnaces. Chapter VI begins with a description of the various laboratory furnaces, followed by the large-scale process of steel smelting. Chapter VII introduces the possibilities of the production of pig-iron from its ores, a considerable amount of space being deservedly devoted to this youngest of electrical industries. The production of steel from metallic ingredients is described in Chapter VIII. The details of this branch of the electrometallurgical industry are now thoroughly well known, and need no further comment.

Chapter IX describes the various attempts made to place the production of steel from iron ore on a commercial basis, but this must still be regarded as in the experimental stage. The manufacture of ferro-alloys and silicon is briefly dealt with in Chapter X, and the production of graphite and carbides in Chapter XI. A considerable amount of space is devoted to the electrometallurgy of zinc and other metals in Chapter XII. This section of the book is extremely interesting, but the industry can scarcely be regarded as having advanced beyond the experimental stage. Chapter XIII describes miscellaneous uses of the electric furnace. The production of nitric acid, phosphorus, and carbon bisulphide is illustrated therein. Various processes of the electrolysis of fused material are described in Chapter XIV, including the production of sodium, aluminium and calcium.

The last chapter attempts to indicate the direction of future development in electric furnace construction, and concludes a very interesting survey of the more important features of electrometallurgy.

The book is fully and clearly illustrated throughout, and freed as far as possible from superfluous details. The text is accompanied by numerous tables and curves. The mathematical and chemical portion of the book is of an elementary nature. Many pages are frequently devoted to the description of plant which has already proved inefficient. This procedure is necessary when it illustrates novel features in furnace construction. The value of the book would have been greatly enhanced had the author given details as to the cause of inefficiency, or at least indicated the reason for suspending operation. There is no doubt, however, that this book forms a very useful addition to our electric furnace literature. The writer is a recognised expert on this subject, and gives a considerable amount of first-hand information. The book will be generally recognised as a standard work on the subject of electric furnaces.

Electrical Engineering in India. By J. W. Meares. Calcutta: Thacker, Spink & Co. Price 15s. net.

This volume represents a most successful attempt to provide a treatment of electrical matters such as is likely to be required by the engineer who, not having specialised in electrical work, wishes to extend his knowledge in this field or to solve some particular problem. The author has succeeded in getting between the covers of a book of reasonable size and price, sufficient elementary matter to furbish up, if necessary, the rudimentary knowledge assumed to have been acquired at one time by the reader; and, in addition, a treatment of the subjects of domestic applications of electricity, installation methods and costs, electrical plant and supply, and sundry heavy-current applications—the treatment being throughout well suited to the end in view. The volume combines the technical merits of treatises on special branches of electrical engineering with the convenience in reference of a pocket book. So many attempts at covering such a wide field have ended in disastrous failure or cursory mediocrity, that it is particularly gratifying to find a work packed full of information, obviously selected with care and experience and set out in such manner that it can be understood and applied by any engineer, whether reading straight through the volume or using it as a work of reference.

Part I—the elementary section of the book—includes practical definitions and explanations of electrical terms and symbols, as well as brief notes on the chief electrical apparatus and machinery, and connecting and distributing systems. The author appears to have realised just what could be left out of elementary notes intended for engineers, and, while including no absurdly elementary or purely academic matter, he has left no gaps unbridged. In Part II, which is concerned with domestic applications and the cost and installation of the apparatus required, electric lighting, ventilation, pumping, heating and cooking are dealt with first, the information presented being a happy combination of descriptive and explanatory matter, and standard data required for general estimating and design and for installation work. The author does not commit the error, made frequently by "practical" writers, of giving arbitrary rules or mere generalisations and qualitative information; definite information and practical examples are given throughout, and where formulæ are included their conditions of applicability are specified. The chapters on wiring and accessories do not encroach upon the ordinary wireman's manual, but contain just the information (general and concerning sizes, capacities and costs) likely to be useful to the engineer called upon to specify and supervise a wiring installation.

Part III, dealing with electric plant and supply, is quite up to the standard of the rest of the book. Direct and alternating-current motors, their characteristics, control, applications and prices are treated satisfactorily, and Chapter XIV is devoted to the important subject of plant for private supply. Determination of the kilowatt capacity required is discussed in detail, brief notes relate to types of generators, and practical information is presented con-

cerning the cost and general characteristics of various types of prime movers. The possibilities of the Humphrey pump in this connection are discussed. Public supply costs are analysed and the subject of tariffs is treated clearly, a number of actual examples being included. Two chapters dealing with water-power and its development include a useful collection of formulæ, standard data and general information concerning turbines, pipe-lines and associated equipment. Chapters on electric traction are equally valuable and contain even more definite data and instructions for its application. Electricity in mining is dealt with in the shortest and least satisfactory chapter in the book; we feel sure it is within the author's capabilities greatly to improve this chapter. Transmission systems, equipments and costs are treated clearly and in sufficient detail, and the last two chapters deal with specifications, depreciation and maintenance, and with testing.

The appendix includes the I.E.E. form of model general conditions of contract. An exceptionally complete index (occupying 33 pages) greatly increases the value of the work, and is the best we remember seeing. In proportion to its size, this book contains very few illustrations, but those included are excellent; it is free from diagrams useless to the readers for whom it is designed, and is unencumbered by the numerous half-tone illustrations, which so often mar works of this nature. We notice few printers' errors; there are one or two dropped figures or letters in mathematical expressions, but not where their absence can cause doubt or confusion. Two blocks are transposed on page 55, but the author informs us that this was due to the printers, after a correct proof had been passed. Some of the data included refer only to India, and Indian coinage is used throughout. The scope and quality of the book are remarkable and, we believe, unique. An Anglicised edition could be prepared easily and should meet a wide demand.—R. E. Neale.

LEGAL.

Calmont, King & Co. *v.* Owen.

In the City of London Court, on Friday last, before his Honour Judge Atherley-Jones, K.C., a claim was made by Calmont, King and Co., Ltd., London, against Thomas H. Owen, cycle and motor dealer, Blaenau Festiniog, to recover £2 13s. 10d. for electric lamps supplied to his order.

Judge Atherley-Jones stated that the defendant had written several letters to the Court, explaining why he should not pay the amount. Plaintiffs' solicitor stated that in October, 1913, plaintiffs quoted defendant for certain electric lamps to be supplied at fixed prices. These prices ruled only for the season. Deliveries took place at those rates, and then prices went up. Defendant now urged that he ought to have the latter deliveries of goods at the former rates. There were three invoices sent up by the defendant to the Court. The first was at the old prices, the second was at an extra price, which defendant had actually paid, and the third was the subject of the present action. The third was for £2 13s. 10d. Defendant had paid £1 8s. 4d. into Court, deducting £1 5s. 6d., the increased price on the old invoices and on the sum now claimed. Of course that could not be allowed. Defendant wanted deductions from amounts actually paid.

Judge Atherley-Jones found for the plaintiffs for the amount claimed, with costs.

Bristol Tramways and their Electric Supply.

In the Chancery Division, on Tuesday, June 8th, Mr. Justice Neville had before him a petition by the Bristol Tramways and Carriage Co., Ltd., for the sanction of the Court to an extension of its powers, including the supply of electricity to other firms.

Mr. Clauson, K.C., who, with Mr. Gordon Brown, appeared in support of the petition, said they had surplus electricity which they desired to supply to others.

His Lordship expressed his approval of the proposed extension of objects, but thought that the notices convening the necessary meetings had not given the required seven clear days.

Under these circumstances, Mr. Clauson asked that the petition should stand over in order that fresh meetings might be held, and be restored to the list for formal sanction; or, should the company think that they could persuade the Court of Appeal to take a different view as regards the notices, dismissed, so that the opinion of the Court might be taken on the point.

His Lordship said the order might go in either way, as the company desired.

BUSINESS NOTES.

Consular Notes.—CUBA.—Recent issues of the *Gaceta Oficial* announce that the following persons have been granted permission to install electric power and lighting plant in Cuba. Senor Francisco Arredondo y Bentancourt at Jobabo, in the municipal district of Victoria de las Tunas; Senor Dorindo Vazquez, in the town of Florida, Province of Camaguey, and Senor Perfecto Rodriguez, in the town of Florida. In each case the concession will be rescinded if the plant is not in working order within a year from the date of the concession.

DOMINICAN REPUBLIC.—The American Consul at Santo Domingo reports that the erection of a new electric light plant in Santo Domingo is so greatly felt that it is a daily subject of discussion in the local Press and by those who, realising the deficiency of the lighting service, are constantly clamouring for its betterment.

In June, 1914, a contract was entered into between the municipality and S. Michelena, whereby it was agreed that there would be created a Corporation, with a capital stock of $160,000, $60,000 of which would always be held by the municipality, with the object of establishing an electrical plant for the public and private lighting of the city of Santo Domingo and the supplying of power for industrial and domestic purposes. Among other things Mr. Michelena bound himself to attend to and complete the formation of the stock company within a specified period of time, after which the work for the erection of the plant was to begin.

The municipal Council in its session of March 30th last passed a report rendered by the city's attorney, in which it was held that the municipality was not bound for the erection of the electric-light plant, and the contract with Mr. Michelena was declared rescinded. In the same session a Committee of three was appointed to study and take under advisement the form and the means for the realisation of the work. It was also resolved to contract a loan for the installation of the new plant.

PHILLIPINE ISLANDS.—The American correspondent at Manila reports that Lucban, Tayebas Province, is to install a hydro-electric plant to supply light and power to the municipality. The proposed plant will cost $30,000. The machinery will be purchased from American importers, and the plant will be ready for operation in August. The project will be financed by Filipino capital, through a corporation floated in the municipality. The power for the plant will be generated by the water of the Pagsipi River, which flows through the municipality. The electric light and power station will consist of a Pelton water turbine, coupled to a General Electric alternator, a concrete dam across the river, a headgate, flume, penstock, a complete power plant, transmission and distributing line. The system will require 42,000 ft. of wiring and 1,600 ft. of flume line, with a capacity of 900 litres a second. Construction will begin at once. Lucban is one of the centres of the Phillipine hat industry. One of the incentives for constructing the new lighting and power system was the great need for better lighting in the houses where the hat industry is being conducted.

RUSSIA.—The Administration of Waterways of the Interior in Russia has prepared an explanatory note in regard to the project of law concerning the utilisation of water-power. The note mentions the latest technical improvements achieved in this direction during the last ten years. The utilisation of water-power is of special importance, inasmuch as the electrical energy obtained can be transmitted to considerable distances. Hydroelectric power can be used in all kinds of industries where motive power is used, but it is of special importance in mining, electrochemical and metallurgical industries, and in the manufacture of a number of articles important in agriculture. Of the greatest importance, however, is the use of hydroelectric power in the exploitation of ways of communication as a change from steam to electricity on railways becomes a necessity in many cases, even for long distances. The 24 large rivers of European Russia, not including the Caucasus, can furnish 1,000,000 H.P., and the hydraulic resources of Siberia have not yet been ascertained. The total supplies of water-power in Russia are estimated by some investigators at 12,000,000 H.P. in comparison with the total supplies in Western Europe of 34,000,000 H.P. Western Europe, as well as the United States, is covered with a network of hydroelectric installations which, in the principal countries of Europe, produce more than 3,500,000 H.P. In Russia a considerable number of applications have been received during the last 20 years, which circumstance has proved the necessity for utilising the water-power, but the granting of concessions, as well as any activity by the Government itself, has been impeded by defects in the Russian regulations. Even in cases where the exploitation of water-power may be given over to private enterprise it is always closely connected with the interests of the State. The right of exploitation conferred on a private individual places him in a position to control industry which, under existing conditions, the Government believes should belong to it. The right of exploitation of the water-power, therefore, should be given to private individuals only on condition that it will be under the control of the State. The regulations which the Government propose to put into force to bring about this end have already been given in detail in the Electrical Review.

Liquidations. — Coast Development Corporation, Ltd.—A meeting of creditors was held on Tuesday last, June 8th, at Winchester House, Old Broad Street, E.C.

Beck Engineering Co., Ltd.—A petition for the winding up of this company has been presented by the Sloan Electrical Co., Ltd., of Conradty House, Golden Lane, E.C., and will be heard on June 15th.

Engraving on Celluloid.—One of the arts in which we have been largely dependent upon Germany is that of engraving on celluloid, and we understand that the great bulk of engineers' rules, scales and protractors were obtained from that source up to the commencement of the war. We are therefore glad to learn from the UNITED METAL ENGRAVING CO., LTD., of 40, High Bridge, Newcastle-on-Tyne, that they have developed a process of engraving on white and clear celluloid which, they claim, is equal, or superior, to the German process. We have received samples of both kinds, a transparent protractor, which is a really beautiful piece of work, and a section of scales for a slide rule which merits high commendation. We trust that the result of the company's enterprise may be the capture of this important branch of German trade.

Fire.—An outbreak of fire at Carron Iron Works, at Falkirk, did considerable damage, the grinding mills and grinding shops, with valuable machinery, including large electric motors, being involved.

A Manchester Exhibition.—The Ironmongery and Hardware Trades' Exhibition, which was opened on June 3rd in the City Exhibition Hall, Manchester, is to close to-morrow, Saturday. Mr. L. A. McGeoch, president of the Ironmongers' Federated Association, Inc., is chairman of the Exhibition. The exhibits include the following:—W. & T. Avery, Ltd., weighing machines; Carborundum Co., Ltd., abrasive materials; Carron Co., electric stoves and cooking and heating apparatus; Excelsior Fibre Co., Ltd., fibre goods; E. O. Walker & Co. (electrical contractors and engineers); G. D. Gibson & Co., Ltd., electric vacuum cleaners ("Doty," "Duplex" and "Dumore"), and electric motors for sewing machines; Eyre & Sons, Ltd., electric light fittings; and the Falkirk Iron Co., Ltd., who are making electric cooking ovens, grills, toasters, fires and other like apparatus.

For Sale.—Salford borough electrical engineer invites tenders for the purchase of 10 miles, 1·2 sq. in., and 2 miles, 1·0 sq. in. single L.T. paper-insulated, lead-covered cable.

The British Gas Co., Bristol, have for disposal about 40 tons of carbon from vertical retorts. Particulars are given in our advertisement pages to-day.

Trade Announcements.—The sales and advertising departments of MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., incandescent lamp and fittings department, Dalston, have now been transferred to 39, Upper Thames Street, E.C. From this address the combined lamp and supplies business will in future be controlled. The rearrangement has been made essential by the rapidly increasing turnover of Wotan and Tantalum lamps. Extensions in the manufacturing departments have been accomplished from time to time, and it will be remembered that exceptionally large premises at Shacklewell Lane were occupied some three years ago to provide store accommodation for the large stocks held by the company. Although this released a certain amount of space and temporarily eased the situation, the introduction of new types of lamps, including gas-filled lamps, demanded that further extensions should be made. As a result Dalston Works will now be devoted solely to lamp manufacture, and the output correspondingly increased. It is also hoped that the centralisation of the lamps and fittings selling organisations will prove to the convenience of customers. All correspondence relating to "Dalston" material should be addressed to 39, Upper Thames Street, E.C.

MESSRS. NEVILLE, WILLIAMS & CO. have disposed of their business as follows:—The Ensign electric fires, heaters and cooking apparatus to Messrs. Ikin & Eads, Ltd., 47, Marylebone Lane, London, W.C., who will continue the branch of the business under the same name and management, and who will accept responsibility for all outstanding guarantees for heater units, and will continue to supply Ensign electric fires and heaters; the Varsulat varnishes, frosting and colouring lacquers and insulating materials to Messrs. Bi-Metals, Ltd., 57, Lant Street, London, S.E.

MR. WILLIAM SWEETMORE, electrical engineer, of Heywood, Lancs., announces that he has removed to more central premises at 6, Market Street, Heywood.

Book Notices.—The *Journal and Transactions*, of the Society of Engineers (Inc.), for May, contains a paper by Mr. A. H. Barker on "Heating and Ventilation" and a discussion thereon, both of which are of interest to electrical engineers, who are in possession of the ideal means of performing these functions.

The *Faraday House Journal* for the Summer term contains a "Note on the Third Harmonic in Transformers," by J. Goodman; an article on "Interpolation," by Dr. Alexander Russell, and a variety of information regarding the fortunes of past and present students, including a supplementary list of those serving in the Allied Forces.

"Constant Voltage Transmission." By H. B. Dwight. London: Chapman & Hall. Price 5s. 6d. net.

Bankruptcy Proceedings.—T. DUESBURY, Engineer, Electricity Department, Sutton Coldfield.—Receiving order made June 4th on creditor's petition.

J. W. & T. W. TATTERSALL (Tattersall & Tattersall), electrical engineers, late of Willesden Lane, London.—Discharge suspended for three weeks from May 11th, 1915.

Australia.—From the British General Electric Co., Ltd., of Australia, we have received a useful hanging wall map of Australia.

Catalogues and Lists.—DOWSING RADIANT HEAT CO., LTD., 39 and 40, York Place, Baker Street, London, W.—24-page illustrated and priced catalogue relating to "Hot-point" irons for industrial (laundry, tailoring, dressmaking and millinery) and domestic use, also "Eadisk" cookers, and "Belenus" boilers, branders, soldering irons and several industrial heating devices. Copies of the catalogue will be forwarded on application.

MESSRS. L. ANDREW & CO., 2, Whitworth Street West, Deansgate, Manchester.—Price list of india-rubber hose, tubings, Leclanché and other batteries, bell wire, &c.

LIGHTING and POWER NOTES.

Australia.—In connection with the agreements entered into between the Sydney City Council and the Municipalities of North Sydney and Waverley, for the supply of electrical energy, the Electric Light Committee of the City Council has recommended that authority be given for the provision and laying of the necessary cables and high-tension network. The cost of the works proposed to be carried out in North Sydney is £31,000, and in Waveley, £10,500.—*Sydney Morning Herald.*

A company is being formed in Melbourne to take over the plant of the Toora (Vic.) Electric Light and Power Supply Co. and to extend the mains to Foster for the purpose of supplying electricity to the town. Under the new scheme it is proposed to utilise the Franklin River Falls, where there is an abundant supply of water, in lieu of the present gas suction plant.—*Tenders.*

Bangor.—PRICE INCREASE.—The City Council has adopted a recommendation of the Lighting Committee to increase the price of current for electric lighting to 6d. per unit.

Barrow.—ANNUAL REPORT.—The report of the year's working of the electricity undertaking shows that the output had increased by 72 per cent. and the revenue amounted £26,585, as against £20,148 in the previous year. The gross profit was £12,718, compared with £8,689, the net profit £3,163, an increase of £2,650. The units sold reached 3,597,410, as against 2,081,317 in the previous year. The total cost per unit was 0·925d., as against 1·321d. in 1914.

Batley.—LOAN SANCTION, &C.—The L.G.B. has sanctioned the borrowing of £3,391 for the purposes of electric cable extensions; the Electricity Committee recommends that the surplus on the revenue account of the electricity undertaking should be applied to clearing off the debit balance on the suspense account. In respect of the cable extensions, the representations made by the Council in London have been of such a character that the electric cable extensions to Healey, Carlinghow and Bradford Road West can be proceeded with.

Belfast.—A Sub-Committee of the Council has been appointed to consider the entire question of the electricity department and its reorganisation, and to report to a special meeting of the Council on or before the 24th inst.—*Belfast News Letter.*

Blackburn.—The Electricity Committee has decided to inform applicants for a supply of electricity in the Wilpshire district that, owing to the war, the Committee cannot see its way to proceed further with the matter at present.

Bradford.—WORKHOUSE LIGHTING, &C.—The new electric lighting installation of the North Bierley B. of G., at Clayton, was formally opened last week. It had been considered that economy might be effected in regard to the lighting of the various buildings, the cost of gas for the previous five years being about £500 per annum. Two engines are being utilised of 18 and 40 B.H.P. respectively, and both can be used for driving the two 25-KW. dynamos or for laundry purposes. Current is supplied for 750 lights. The estimated cost of the installation is £1,260. Mr. T. Roles, the city electrical engineer, has acted as consultant for the scheme.

The Corporation Electricity Committee has decided to make a contribution of £10 for the current year to the funds of the Engineering Standards Committee.

Bredbury and Romiley.—The U.D.C. has consented to overhead wires being erected in connection with the supply of electricity to the district from Stockport, provided that the cables are laid underground when the Council requires it.

Burnley.—The L.G.B. having intimated that it would not be prepared at present to sanction the raising of any further moneys for the purpose of laying ordinary service cables, the E.L. Committee has decided that the cost of laying and connecting of services be paid out of revenue.

Cheriton (Kent).—CAMP SUPPLY.—The Military authorities have erected a generating station on St. Martin's Plain, and overhead wires have been carried over the public roads without any arrangement with the U.D.C. The Council has decided to communicate with the authorities on the matter, so as to fix responsibility should any accident arise from the live wires.

Chichester.—Restricted Lighting.—Owing to restricted street lighting, the Electricity Co. has allowed the T.C. a rebate of £100 on the public lighting contract, which has been cancelled. A new contract is based on a sliding scale of charges, according to the number of lamps used.

Colchester.—Year's Working.—During the last financial year, the Corporation electricity department sold 1,658,596 units, an increase of 25,000 on the previous year. The revenue for the year was £18,110, and the gross profit £7,813; the surplus after meeting financial charges, £813, was carried to reserve. It has been decided to increase all lighting charges by ½d. per unit.

Continental.—Spain.—Two concessions have been granted, according to *Industria e Invenciones*, for the establishment of hydroelectric works for the generation of electric current for local lighting purposes. The site of one of these stations is on the River Molins, near Tobera, in the province of Burgos, and of the other on the River Mundo, in the province of Albacete.

Doncaster.—Proposed Loan.—The L.G.B. has suggested that the Corporation's application for sanction to borrow £2 500 for electrical service mains be deferred.

Dover.—Proposed Loans.—The L.G.B. has sanctioned a loan of £1,000 for new services on condition that the money is spent on work for the Naval and Military authorities only. The cost of other connections will be met out of revenue. With reference to an application for a loan of £6,000 for a 1,000-kw. set, the L.G.B. has pointed out that the circumstances justify a smaller machine being installed. The T.C. has decided to let the matter stand over.

Annual Accounts.—The report of the Corporation electricity department for the year ended March 31st last shows total receipts amounting to £25,669, and a net profit, after payment of all outgoings, of £2,928. During the year 330,000 more units were sold than in the previous year.—*Dover Express.*

Dundee.—The report of the Corporation electricity department for the past year shows an increased revenue of £6,739 over the preceding year. Expenditure had increased to the extent of over £7,500. Dealing with the estimates for the current year, owing to the abnormal price of coal, &c., the expenditure is estimated at fully £13,000 over last year. From this must be deducted the net profit carried forward of £2,835. To cover the balance the estimates have been framed with 10 per cent. extra price on lighting, 10 per cent. on tramways supply, and 15 per cent. on power. The accounts and estimates were approved.

Durham.—Price Increase.—The Newcastle Electric Supply Co. has increased the price of current supplied in the city by ·02d. per unit for every 6d. by which the average quarterly cost of coal used is above 7*s.* per ton, or *pro rata* for smaller variations of cost.

Enfield.—Street Lighting.—As the North Metropolitan E.P. Distribution Co. has not responded to an invitation to submit proposals for street lighting by electricity, the U.D.C. has decided to ask the Tottenham District Light, Heat and Power Co. if it is prepared to continue the lighting for a further year from July 1st on the terms contained in the existing contract.

Frimley.—Prov. Order.—At a meeting of the D.C. on June 1st, it was reported that the York Town and Blackwater Gas Co. had written urging the advisability of delay in laying the E.L. cables; the Council decided not to acquiesce in the company's proposed application to the B. of T. for an extension of time in which to carry out the obligations under the prov. order for E.L.

Gillingham (Kent).—The T.C. has decided to give a supply of current at ·7d. per unit to Messrs. Goldsmith, for the Rainham Cement Works, providing the firm undertakes the whole responsibility of laying the cable, the Council to have the option of purchasing the same.

Gloucester.—Loan Sanction.—The L.G.B. has, according to a local paper, telegraphed its consent to the request of the Electricity Committee for permission to lay a main, at a cost of £1,500, to supply the Gloucester Railway Carriage and Waggon Co., which is engaged on Government work.

Grays.—Increased Prices.—In order to meet the large increase in the price of coal, advanced wages, &c., the T.C. has increased the charges for current for lighting and power by 10 per cent. from July 1st.

Grimsby.—Year's Working.—During the year ended March 31st the Corporation electricity department sold 2,787,298 units, showing a slight increase on the previous year. The year's working resulted in a net profit of £2,817, as compared with £4,061 in the previous year, and after making certain appropriations to capital outlay and for war charges, a balance of £721 remains for disposal. The engineer, Mr. Vignoles, points out that the first six months of the year were very satisfactory, but judging from the last quarter, a serious loss in revenue from private consumers must be anticipated unless conditions change.

Hove.—The T.C. has been recommended to accept the revised terms of 5½d. and 1½d. per unit for the first and succeeding hours respectively, submitted by the Brighton Corporation for current supplied to Aldrington, and is also recommended to increase the charge for current to consumers at Aldrington from 5d. to 5½d. per unit as from 30th inst.

Kendal.—The T.C., in consequence of the great increase in the cost of coal and other materials, has decided to advance the price of current to consumers for lighting by 1d. per unit, and to kinemas and to power consumers by ½d. per unit, the increase in each case being one-sixth.

Lancaster.—Year's Working.—The annual report of the electricity department for the year ended March 31st, shows that the revenue amounted to £9,111, as compared with £9,185 in the previous year. The total expenditure shows a reduction of £135; there was a decrease of 8,967 units sold for lighting, and of 20,741 units for power. The total net profit was £410, as against £348, and this has been carried to reserve.—*Lancaster Guardian.*

London.—Battersea.—The Electricity Committee reports having been in negotiation with the Fulham and Hammersmith B.C.'s, with a view to linking up the undertakings of the three municipalities. The estimated cost of laying two ·15 sq. in. mains between Battersea—Fulham—Hammersmith is £17,441, to be borne equally between the three Councils concerned. The Committee recommends an agreement being entered into; the Finance Committee recommends application being made to the L.C.C. for sanction to, and the advance of, a loan of £5,814, the Council's share of the estimated cost of mains.

Poplar.—The Finance Committee of the B.C. has considered the report of the Electricity Committee on the disposal of the net surplus of the electricity undertaking, for the year 1914-15. The Committee has deferred consideration of certain of the proposals, but recommends that the proposal to transfer £3,500 to the credit of the general fund be approved.

St. Pancras.—The Finance Committee of the L.C.C. has notified the B.C. that it is prepared to recommend the borrowing of £15,000 by the B.C. for a new 5,000-kw. turbine, subject to the B.C. agreeing to repay within one-half of the period now unexpired, the debt outstanding on the plant and machinery for which a term of 42 years has been granted, and which will on the introduction of the new machinery fall within the category of stand-by plant. The condition is not to apply to the 2,360-kw. of plant, which it is stated will be required for working plant in daily use. The recommendation of the L.C.C. is subject to the consent of Treasury.

The B.C. has decided to adhere to its previous decision in regard to the reduction of outstanding loan periods and points out that the proposed £15,000 expenditure is very urgent, as the B.C. has already incurred liability for the amount in question.

In connection with the completion of the loan of £22,530 for new boilers at King's Road electricity station, application is to be made to H.M. Treasury for consent to the borrowing of the amount as the additional boiler accommodation is very necessary.

Loughborough.—Year's Working.—The past year's working of the Corporation electricity undertaking resulted in a gross profit of £2,992, as against £2,759 in the previous year, and a net balance of £104 remained after meeting all charges, as against £392 in 1914. During the year 929,000 units were sold; the maximum load was 559 kw., and the connected load 1,505 kw. The motors connected totalled 940 b.h.p., and the works costs at ·836d. per unit represented a fall of ·108d. as compared with 1914.

Luton.—Plant Extension.—In view of the necessity of increasing the generating plant to provide security in the supply to many firms engaged in Government work, the engineer, Mr. Cooke, has advised, and the Electricity Committee agreed to, the purchase of a 3,000/3,700 kw. Ljungstrom turbine set, to be erected within six months, at a cost of £11,175. An additional air filter, cooling tower, and piping will bring the cost up to £14,450. Further, he recommends the erection of a sub-station and installation of two 500-kw. converters at a cost of £5,200; this building will provide accommodation for an additional 2,000 kw. of converting plant. High and low tension cables will also be required at an estimated cost of £6,000, making a total proposed expenditure of £25,650, the borrowing of which it is proposed to ask the L.G.B. to sanction.

Middleton.—Price Increase.—The Electricity Committee has increased the price of electricity from June 1st as follows:—For lighting purposes by ½d. per unit, for motor power purposes by 12½ per cent.

Midhurst (Sussex).—The Midhurst and District Electric Supply Co. has applied to the B. of T. for consent to use 400-volt overhead transmission lines at Midhurst, Easebourne and West Lavington.

Manchester.—The Ratepayers' Association has forwarded a letter to the Treasury urging that sanction should not be given at present to the carrying out of the £500,000 electricity scheme at Barton, as it would tend to draw skilled labour from work more immediately necessary for the prosecution of the war.

Morley.—Year's Working.—The annual report of the borough electrical engineer shows that the total expenditure for the past year was £2,284, as compared with £2,228 during the previous 12 months. There was a gross profit of £1,640 on a total revenue of £3,925, but after payment of interest on loans and sinking fund charges there was a net deficit of £301, as against £443 in the previous year.

Northampton.—New Power Station.—The Finance Committee of the T.C. has considered the proposals of the Northampton Electric Light and Power Co. to construct a new generating station on land on the south side of the river, opposite Midsummer Meadow. The Committee states it has no desire to hamper the operations of the company, but as the greater part of the receipts of the undertaking are, and will continue, to be derived from consumers in the borough, and the borough funds will receive no benefit from the rating of the proposed station, which will be virtually wholly situated outside the borough; it has directed the town clerk to notify the B. of T. that the proposals are open to objection from this point of view, and to draw the attention of the company to the nuisance which might arise from smoke from the chimney stacks of the projected generating station.

Oulton Broad.—Restricted Lighting.—With reference to the rebate for street lighting, which has been previously referred to in the Electrical Review, the U.D.C. has offered the Electricity Co. 60 per cent. of its account during the time the restricted lighting is in force. This, it is understood, is acceptable to the company.

Peterborough.—Year's Working.—The accounts of the electricity undertaking for the year ended March, 1915, show that the revenue amounted to £10,393, as against £10,231 in the previous year; the total working expenditure was £5,647, against £5,415. With interest, provision for repayments and capital expenditure out of revenue, the capital expenditure was £7,217 for the year.—*Peterboro' Standard.*

Reigate.—Infirmary Lighting.—The B. of G. has decided to adopt electricity for lighting the new infirmary; inquiries will be made of the T.C. as to rates for supply.

Rochdale.—Proposed Loans.—It is proposed that application be made to the L.G.B. for sanction to the borrowing of £4,400 for electricity mains. The Board is also to be requested to consent to the borrowing of £20,171, to cover the amount payable to contractors on existing contracts, the whole of the expenditure having been sanctioned by the L.G.B. in March, 1914.

Rotherham.—Loan Sanction.—The Treasury has sanctioned the borrowing by the Corporation of £8,400 for the purchase of two water-tube boilers for the electricity undertaking.

St. Annes.—Year's Working.—The annual report of the electricity works states that the revenue for the year amounted to £12,055, compared with £11,725 for the previous year. The total working expenses amounted to £6,573, compared with £6,211, and the total expenditure to £7,787, leaving a gross profit of £4,268. The gross profit was equal to 7·84 per cent. on the capital outlay at the commencement of the year. During the year 1,194,703 units were sold.

St. Helens.—Year's Working.—The charges for electricity are to be increased by 10 per cent. from July 1st.

The revenue from the undertaking for the past year amounted to £30,179, and the total expenditure to £29,641, there being a net profit of £538.

Shipley.—Year's Working.—The income from the electricity undertaking for the past year was £13,226 and the expenditure £13,629, leaving a deficit of £403. The deficit is due to increased wages and assessment and heavy expenditure on new plant.

New Plant Inaugurated.—Last week two new turbo-alternators were formally started up at the electricity works, and will replace the four original turbine sets. The new plant will halve the unit steam consumption of the original machines and facilitate supply to local factories.

Stretford.—During the past year the total number of units generated was 2,782,600, as compared with 2,726,355 in the previous year.

In connection with the lighting of Longford Hall, a cable is to laid from the street mains to the hall, at an estimated cost of £50.

Swansea.—Year's Working.—The annual report of the Electric Lighting and Tramways Committee for the year ended March 31st last, shows a total income amounting to £33,297, as against £32,986 for the previous year. The total works expenditure was £18,965, as against £18,562, including an allowance of £397 to men on military service; there was an increase of £1,400 on the loan charges, and the net result of the year's working was a profit of £1,786, as against £3,312 for 1914. The reserve fund amounts to £8,996. The profit has been carried to the rate account.

Tasmania.—The contracts made by the Hydro-Electric Co. have now been transferred to the Government, and Mr. Dickinson, of Messrs. Alfred Dickinson & Co., has accepted the position of consulting engineer.

The question of the utilisation of the power derived from this scheme has been under consideration, particularly in connection with the proposed electrical treatment of the Blythe River and other iron deposits. Owing to the large outlay that would be necessary for a steel rail-making plant, and in view of the fact that the Newcastle works are to specialise in that direction, attention has been directed to the possibilities of producing other marketable lines, such as steel fencing wire. It is assumed that a charge of £2 per H.P. per annum would pay the cost of the transmission line, and that on this basis the cost of manufacture would be less than by blast furnace smelting.—*Commonwealth Engineer.*

Tunbridge Wells.—Loan Refused.—The L.G.B. has refused consent to a loan for additional boiler plant and a new cooling tower at the Corporation electricity works, on the ground that there is no immediate necessity for the work. The Board has also decided to cancel £1,696—portion of a loan of £6,658 sanctioned on November 14th, 1907, and not expended.

Wakefield.—The Council has resolved to discontinue its opposition to the Stanley Electricity Order before Parliament.

The Council has also decided to apply to the L.G.B. for sanction to borrow £4,000 for the remodelling and extending of the destructor plant.

L.G.B. Inquiry.—An inquiry has been held concerning the application to borrow £4,000 for extensions of the electricity undertaking. It was estimated that the sum asked for would meet the requirements of the department for two years. There was no opposition.

Weaverham.—The Weaverham Electric Supply Co., Ltd., has entered into a contract with the Weaver Refining Co., Ltd., Acton Bridge, for a minimum supply of 50,000 units per annum for three years.

West Bromwich.—The T.C. has decided to increase the price of electricity to all consumers 20 per cent. in order to meet the extra cost of materials and wages.

TRAMWAY and RAILWAY NOTES.

Ashton-under-Lyne.—A deputation representing the tramwaymen employed by the three authorities in the Ashton district, waited upon the authorities on the 4th inst., with a view to getting them to reconsider their refusal of an application for an increase of wages. It is understood that the authorities decided to adhere to their previous decision.

Blackpool.—Women Conductors.—Some 99 employés of the Tramways and Electricity Department are now on war service, and six men are on munitions service. The Tramways and Electricity Committee has authorised the engagement of 12 women conductors, authority also being given to increase the number in the event of these being insufficient. The women conductors will receive the same rate per hour as youths receive during their first year of service as conductors, but their hours will probably be shorter.

Bolton.—War Bonuses.—The application of the local branch of the Amalgamated Association of Tramway and Vehicle Workers for a war bonus of 2s. 6d. per week for motormen, overhaulers, cleaners and day labourers, has been refused. Other alleged grievances of the men have been referred to the manager and the representatives of the Association for mutual adjustment.

Bradford.—Year's Working.—The working of the Corporation tramways during the year 1914-15 shows a net profit of £32,500, as compared with £29,500 the previous year. The total income was £305,000, an increase of £8,000 on 1913-14, representing 11¾d. per car-mile as compared with 11½d. The expenditure totalled to £272,500, and included an item of £2,800 for war allowances. Rates and taxes were reduced by £2,000 on account of reassessment of the undertaking. The total mileage run was 6,372,000, as against 6,256,000. In connection with the Corporation's railless system, there was an increase in receipts of £2,800 consequent upon the opening of new routes in the city; the total income was £4,316 (5¾d. per car-mile), as against an expenditure of £6,016 (8d. per car-mile), there being therefore a deficit of £1,700, as compared with £414 a year ago. During the year renewal of track absorbed £22,300 as against £17,600. The reserve and renewals account now stands at £75,208, and the total capital expenditure at £1,052,000, of which £440,000 has been repaid.

Burnley.—War Bonuses.—An application by the Corporation's tramway employés for a bonus of 3s. per week has been refused by the Tramways Committee, and the refusal has been confirmed by the General Purposes Committee.

Doncaster.—Proposed Loan.—The B. of T. has intimated to the T.C. that it is unlikely that the loan of £8,550 applied for for the tramway undertaking will be sanctioned.

London.—On Monday last a collision occurred between two L.C.C. cars near the main gates of the Arsenal at Woolwich. Eleven people were injured, three seriously.

One effect of the recent strike of L.C.C. tramwaymen was a decrease in receipts, in two weeks, of over £53,653, as compared with the same period of last year.

A new tube station at Maida Vale has been opened, on the line from Paddington to Queen's Park. The station is entirely staffed by women.

Manchester.—The Tramways Committee has decided not to accede to an application from the Municipal Employés' Association for an advance of wages on behalf of certain grades of workmen in the employ of the department.

At the City Council, on Tuesday, it was stated that the number of Corporation tramway employés who had joined the Colours was 1,925, and in a few weeks it would be 2,000. The cost to the city was now £1,316 per week.

Rochdale.—The building of the new car-shed has had to be postponed owing to the impossibility of obtaining a loan for the purpose.

Sheffield.—WOMEN CONDUCTORS. — The Corporation tramway department has decided to employ women car conductors and cleaners. Already 80 women have specially volunteered for this class of work.

The general manager of the undertaking has been requested by the Municipal Tramways Association to act as its representative on the Electric Vehicle Committee of the I.M.E.A.

Sunderland.—The Corporation Tramways Committee has decided to engage 12 women as car conductors.

Stalybridge.—The Dukinfield T.C. has decided to petition against the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board's Bill in the House of Commons.

West Ham.—YEAR'S WORKING.—There is a surplus of £272 on the working of the tramway undertaking of the Corporation during the year ended March 31st last. It is proposed to transfer this sum to the reserve and renewal funds. The expenditure amounted to £119,935, and the income credited to the revenue account to £152,212, which includes £3,786 in respect of receipts due from other authorities in connection with through running. It has again been found necessary to realise part of the investments to cover the cost of renewals, &c. The investments at March 31st stood at £15,613, after the foregoing realisations, but the whole of the reserve and renewals fund has now been earmarked for various purposes.

The B. of T. has given its sanction to the borrowing of £1,560 for the replacement of the controllers on the tramcars. In view of the desirability of confining fresh capital expenditure at the present time within the narrowest possible limits, the Corporation has been recommended, at the request of the L.G.B., to postpone the purchase of the 15 new tramcars until after the war.

TELEGRAPH and TELEPHONE NOTES.

A Telegraph Spy Charge.—Abdon Jappe, a Dane, was remanded at Plymouth on Tuesday on charges of attempting to elicit for the enemy information respecting warships, and of possessing apparatus capable of tapping telegraphic and sending telephonic messages.

Australia.—The Post Office accounts for 1913 and six months of 1914 show a deficit on working of £53,547, as compared with £20,081 for the previous year. After charging interest, pensions, &c., the total loss was £501,456, compared with £407,102. The increased deficit was largely due to arbitration awards affecting postal electricians and linemen. There were 132,699 telephones in use in the Commonwealth, and in five of the six States automatic exchanges had been opened or were under construction. A loss of £151,446 was incurred on the telegraph branch, but the most serious loss was due to the telephone service, amounting to £296,424. Wireless telegraphy showed a deficiency of £35,656, compared with £11,599 in the previous year.

The capital expenditure on telephone lines and equipment, exclusive of trunk lines, was £1,125,625, and on telegraph and telephone trunk lines £267,242. The working expenditure in the telephone branch was £1,079,461, an increase of £149,549. A Committee was appointed to inquire into the large deficiency in connection with the telephone service, and its report is now under consideration; it is stated that immense economies are possible.

In accordance with the scheme approved by the International Time Commission of Paris, Melbourne radio-station is now transmitting time signals at the hours of noon and midnight, Melbourne time—which is 10 hours ahead of Greenwich mean time.—*Wireless World.*

Canada.—Our correspondent writes:—1,136 telephone companies have made returns for 1914, compared with 1,075 in 1913. The miles of wire now in use amount to 1,343,090, an increase of 250,563 over 1913. In 1914, the urban mileage amounted to 926,947, the rural to 380,142. There is 1 mile of telephone wire for every six of population. The number of telephones in use is 521,144, or one for each 15·5 of population. There is no other country, except the United States, which can show so high a ratio.

China.—The Government proposes to carry out an extensive plan for the installation of wireless telegraphy, especially in the North-Western provinces.—*Eastern Engineering.*

Pacific Cable.—The story that an attempt had been made to cut the cable at Bamfield, B.C., has been officially contradicted.—*T. and T. Age.*

Trans-Atlantic Wireless.—Wireless communication between the United States and Germany has been severely handicapped lately by static conditions prevailing in the North Atlantic at this season of the year. The wireless station at Sayville, L.I., has been frequently isolated from the sending plant at Nauen, Germany. The same conditions exist at the Tuckerton, N.J., plant. Such messages as are received at Sayville are, for the most part, fragmentary, or often impossible to decipher.—*T. and T. Age.*

United States.—The first daylight message from the new naval radio station at Darien, in the Panama Canal Zone, to the Navy radio station at Arlington, near Washington, was received on April 30th. The distance is 2,000 miles. The sending and receiving radius of the new Darien station is 4,000 miles. The radio installation at the Darien station is on the Poulsen arc system, and this station will be the most powerful in the world using exclusively this type of equipment. Since the United States Navy has been in temporary control of the German radio station at Tuckerton, the Poulsen arc system has been installed at that point and is being successfully used in communicating in daylight, as well as by night, with the station at Eilvese, Germany, over a distance of about 4,000 miles. The number of words handled each week averages about 10,000.—*Electrical Review* (*U.S.A.*).

Wireless Injunction.—The U.S.A. Circuit Court of Appeals has affirmed the order of Judge Hough, granting a preliminary injunction restraining the De Forest Radio-Telephone and Telegraph Co., the Standard Oil Co., of New York, and Lee De Forest from infringing the fundamental Marconi and Lodge patents relating to wireless telegraphy.—*T. and T. Age.*

Wireless Amalgamation?—According to the *Financial News*, the presence of Mr. S. F. St. J. Steadman on the board of the new Poulsen Wireless Co., the registration of which was announced in our last issue, is very significant. Mr. Steadman is the private legal adviser of Mr. Godfrey Isaacs, and his new directorship coincides with reports that the relations between the Government and the Marconi Co. are not so intimate as they were, and that in future the Poulsen system is likely to occupy a more prominent position than formerly. It suggests that "the Poulsen people are tending to coalesce with those who control the Marconi Co."

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—MELBOURNE.—Aug. 11th. One 1,000-KW. D.C. generator complete, liquid starter, &c., for City Council. See "Official Notices" June 4th.

ADELAIDE.—July 14th. Galvanised-iron wire, for P.M.G.'s Department. See "Official Notices" June 4th.

SYDNEY.—July 19th. City Council. Meters for the Electric Light Department, Town Hall. Specification 10s. 6d.

July 19th. City Council. Maximum-demand indicators. Specification (10s. 6d.) from Electric Light Department.

July 19th. Steel towers for 33,000-volt transmission line. Specification (10s. 6d.) at E.L. Department, Town Hall.

July 21st. N.S.W. Government Railways and Tramways Department. One 250-K.V.A. turbo-generator.*

Specifications for the items marked * can be seen at the B. of T. Commercial Intelligence Branch in London.

Batley.—June 16th. 1,500 tons of pea nuts (washed) for the Corporation electricity station. Manager, Electricity Works.

Belfast.—June 16th. Corporation. Six or 12 months' supply of steam coal (23,000 or 45,000 tons respectively) for the electricity works. Forms of tender from Mr. T. W. Bloxam, City Electrical Engineer.

Colchester.—June 15th. Steam coal (about 5,500 tons), for the Corporation Electricity Works. Mr. W. Frisby, Electrical Engineer.

Ealing.—June 21st. Coal for the T.C. Electricity Works. Mr. J. Douglas Knight, Electrical Engineer and Manager.

Eastbourne.—June 26th. 160 ft. of 14-in. cast-iron circulating water piping and valves. See "Official Notices" to-day.

Edinburgh.—June 21st. Two 5,000-KW. turbo-alternators and condensing plant, for Portobello supply station. See "Official Notices" May 21st.

Exeter.—June 14th. Corporation. Three or six months' supply of steam coal, for the Electricity Department. Specification from the Town Clerk.

Glasgow.—June 16th. Corporation. 145,000 tons of coal (singles and pearls) for the electricity generating station. Specification from Mr. W. W. Lackie, 75, Waterloo Street.

Kirkcaldy.—June 14th. Corporation. 100 half-watt 1,000-C.P. lamps and lanterns for street lighting. See "Official Notices" May 28th.

Lancaster.—June 19th. Corporation. Six, nine, or 12 months' supply of coal and slack for the electricity works Forms of tender from Mr. J. B. Patterson, Electricity Works.

London.—ST. PANCRAS.—June 14th. Corporation. Twelve months' supply of Welsh and steam coal for the electricity stations.

METROPOLITAN ASYLUMS BOARD.—June 30th. Lighting installation at the Grove Fever Hospital, Tooting Graveney, S.W. See "Official Notices" to-day.

FULHAM.—June 30th. 11,000 tons of coal, for the Borough Electricity Works. See "Official Notices" to-day.

WEST HAM.—June 14th. Installation of lighting and water-heating apparatus at Knox Road Special School, for Education Committee. See "Official Notices" May 28th.

Manchester.—June 16th. 40-KW. steam dynamo for Cottage Homes, Styal, for Manchester Union. See "Official Notices" June 4th.

Maidenhead.—Coal for the T.C. electricity works for year ending September 30th, 1916.

Plymouth.—June 24th. 13,500 tons of steam coal for the Electricity Department. Specification from the Electrical Engineer.

Rangoon.—August 11th. Installation of a system of fire-alarms, for the municipality. Specification (10s.) from Messrs. Ogilvy, Gillanders & Co., 67, Cornhill, E.C.

Redditch.—June 14th. H.T. three-phase switchboard. See "Official Notices" May 28th.

Shrewsbury.—June 18th. Corporation. Twelve months' supply of best rough slack and best steam coal, for the Lighting Committee. Particulars from Mr. C. M. Johnston, Engineer and Manager.

Tasmania.—LAUNCESTON.—July 26th. Sub-station equipment. Section I, Converter machine, switchgear, &c.; Section II, Underground feeder cable. Specification (21s.) from the City Electrical Engineer, Town Hall.

HOBART.—July 5th. Lead-covered telephone cables; glassware and other material for batteries; telephone instruments, &c., for P.M.G.'s Department. See "Official Notices" May 28th.

Warrington.—June 18th. E.H.T. cable, for Electricity and Tramways Committee. See "Official Notices" to-day.

Wigan.—June 21st. Corporation. Two water-tube boilers with mechanical stokers. See "Official Notices" to-day.

CLOSED.

Australia.—The following contracts have been placed:—

P.M.G.'s Department, South Australia.—
28 tons galvanised iron wire, 400 lb. per mile, £20 5s. per ton.—R. Johnson, Clapham & Morris.
51 tons H.D. copper wire, 200 lb. per mile, £96 per ton.—B.I. & Helsby Cables, Ltd.

Victorian Railways Dept. (Electrical equipment of Melbourne suburban system.)—
Track, feed-boxes, signal transformers, switchgear, &c., £15,512.—A. Reyrolle & Co., Ltd.
Electrically-operated car-shed cranes, £4,480.—Chambers, Scott & Co., Ltd.
Track bonds, £7,095.—B.I. & Helsby Cables, Ltd.
Fuse, distribution boxes and fuses (Schedule rates).—Siemens Bros. Dynamo Works, Ltd.

N.S.W. Railways and Tramways Dept.—
Electrically-driven capstans for Bullock Island, £4,682.—Meadowbank Manufacturing Co. —*Tenders.*

P.M.G.'s Department, South Australia.—
22,800 insulators, porcelain.—F. Kanematsu, £581.

P.M.G.'s Department, Victoria.—
Accumulator battery, Tudor type, for Perth, W.A., £321.—J. R. W. Gardham.
Three miles cable, paper-insulated, 104 pairs, £392 per mile; three miles cable, paper-insulated, 39 pairs, £323 per mile.—British Insulated and Helsby Cables, Ltd.

Sydney Board of Water Supply.—Ryde pumping station, one steam turbine and condenser, Mobbs' Hill pumping plant.—
Willans & Robinson, £4,041.
William Adams & Co., £5,166.
Belliss & Morcom, £4,275.
Australian General Electric Co., (a) £4,375, (b) £4,917.
Standard Waygood Hercules, Ltd., £5,500.
Falkiner Electric Co., (a) £5,250, (b) £5,065, (c) £5,390, (d) £5,210, (e) £4,675, (f) £4,490.
Haes & Eggers, (a) £3,867, (b) £4,685, (c) £4,896, (d) £5,575, (main tender) £4,216.
The Engineer-in-chief recommends the acceptance of Messrs. Willans and Robinson's amended tender for £4,289.

Sydney City Council.—Street lamp fittings—
British General Electric Co., alternative £816, formal tender £1,035.
Aust. General Electric Co., alternative D £1,107, alternative B £1,235, alternative C £1,249, alternative C1 £1,370.
W. G. Watson & Co., formal tender £1,399.
Aust. General Electric Co., formal tender £1,497.
W. G. Watson & Co., alternative A £1,458.
Aust. General Electric Co., alternative B1 £1,543.
W. G. Watson & Co., alternative B £1,706.
Aust. General Electric Co., formal £1,732.
W. G. Watson & Co., alternative D £1,764.
Aust. General Electric Co.'s tender alternative B1, amounting to £1,543, recommended for acceptance.

Nitre incandescent lamps.—
Lawrence & Hanson, for lamps manufactured in Holland, £481.
Aust. General Electric Co., for lamps manufactured in America, £461.
W. G. Watson & Co., for lamps manufactured in Holland, £534.
Aust. General Electric Co., for lamps manufactured in England, £556.
British General Electric Co., for lamps manufactured in England, £875.
Aust. General Electric Co.'s tender for £481 recommended for acceptance.

Transformer testing apparatus.—
Aust. General Electric Co., £269.
Haes & Eggers, £329.
Aust. General Electric Co.'s tender recommended for acceptance.

Insulator pins.—W. G. Watson & Co., Ltd., £64; W. Elder & Co., £100; Storey & Keers, £100; J. Sonnerdale & Son, £129; W. Adams & Co., £283, Messrs. W. G. Watson & Co.'s tender recommended for acceptance.

Bradford.—The Tramways Committee has accepted the tender of the M. & G. Truck and Engineering Co., Ltd., for 100 tramcar trucks at £87 each, and Messrs. Brown, Boveri & Co., Ltd., for 200 tramcar motors at £110 each.

The Electricity Committee has accepted the offer of Messrs. Hayward Bros. & Eckstein, Ltd., London, for glass flooring (switchboard lights) at Valley Road Electricity Works, at £118; also that of the British Westinghouse Co. for two oil switches.

Caledonian Railway.—The Edison & Swan United Electric Light Co., Ltd., has received a contract for Royal Ediswan lamps.

Chelmsford.—The Essex Education Committee has accepted the tender of Mr. E. C. Porter for the E.L. installation at the County High School for girls, Chelmsford, at £73.

Crewe.—The T.C. has accepted the tender of Messrs. J. Simon & Sons for best Great Row slack coal for the electricity works, at 16s. 10d. per ton, subject to satisfactory tests.

Darwen.—The T.C. has accepted the tender of Messrs. G. B. Leach & Sons for coal for the electricity works for one year.

Dartford.—The U.D.C. Electric Supply Committee has accepted the offer of Messrs. E. J. & W. Goldsmith, Ltd., to supply 890 tons of Rubbly Culm, at 19s. 6d. per ton delivered.

Hull.—The Education Committee received 10 tenders for the electric lighting installation and fittings for the new girls' secondary school. That of Messrs. T. W. Vaughan & Co., Ltd., London, at £1,009, has been accepted. It was pointed out that the tender was £400 less than any other, and it was suggested that a mistake had been made.

Leigh.—The following tenders have been provisionally accepted:—

Rotary converter, £895.—Bruce Peebles & Co., Ltd.
Switchgear, £71.—Switchgear & Cowans, Ltd.
Stirling boiler, £2,044.—Stirling Boiler Co., Ltd.
Underfeed stoker, £408.—Underfeed Stoker Co., Ltd.

Meter Contracts.—The Wallasey Council has placed a contract for 12 months' supply of single-phase meters with the Electrical Apparatus Co., Ltd. The St. Annes U.D.C. has made a contract with the same company for 100 D.C. house-service meters during the next 12 months.

Messrs. Chamberlain & Hookham, Ltd., have received contracts for meters for the coming year from Paisley and Wallasey.

The British Thomson-Houston Co., Ltd., has received a contract from Wallasey County Borough for 12 months' supply of S.P., A.C. house-service meters. Messrs. Ferranti, Ltd., have secured a contract for annual supply of A.C. meters for the same Corporation.

Sheffield.—The following tenders have been accepted by the Electricity Supply Committee:—

Underfeed Stoker Co., Ltd.—Renewal of mechanical stokers at Neepsend, £3,165.
Bradshaw & Co.—Two natural-draught water-cooling towers, including foundations and all fittings and accessories, £8,514.
E. Taylor, Ltd.—Excavations and building of reinforced concrete retaining wall at Neepsend, £2,246; also excavating trench and laying 21-in. cast-iron drain pipe, £699.

The tender of Messrs. Brown, Bayley's Steel Works, Ltd., has been accepted by the Tramways Committee for the supply of 500 steel tramcar tires.

Stockport.—The following tenders have been accepted by the Electricity Committee:—

W.I. water-piping for exhaust, and 1,250 new stoker links.—Babcock and Wilcox, Ltd., £85 and £26.
Oil filter.—C. C. Wakefield & Co., £13 10s.
Stanchions for new crane.—Leah & Rowbotham, £109.
Patent roof-glazing, engine-house extension.—Mellowes & Co., Ltd., 1s. per sq. foot.
A.C. testing set.—Eckstein, Heap & Co., Ltd., £41.
Feed-water heater, with separator.—Worthington Pump Co., Ltd., £144.
20-in. valve for circulating pump.—Alley & Maclellan, Ltd., £19.
Circulating water screens.—F. W. Brackett & Co., Ltd., £100.
5-B.H.P. motor for driving screening apparatus.—McClure & Whitfield, £31.

The Health Committee has accepted tenders of Messrs. McClure and Whitfield for electric lighting, at £58 and £22 respectively.

Sunderland.—The T.C. on Wednesday accepted the following tenders:—

British Thomson-Houston Co., Ltd.—Bearings for split-pole rotary.
Doulton & Co.—Stoneware insulators.
Key Engineering Co.—Cable ducts.
B.I. & Helsby Cables, Ltd.—E.H.T. cable and copper strip.

FORTHCOMING EVENTS.

North of England Institute of Mining and Mechanical Engineers.—Saturday, June 12th. At 2 p.m. At Newcastle-on-Tyne. General Meeting.

Salford Technical and Engineering Association.—Saturday, June 12th. At 3 p.m. Visit Stuart Street Power Station, Manchester.

Point Five Association.—Thursday, June 17th. At 7 p.m. At Tricity House, Oxford Street, W. Meeting.

Incorporated Municipal Electrical Association.—June 17th and 18th. At Institution of Electrical Engineers, Victoria Embankment, W.C.
Thursday, June 17th.—At 10 a.m. and 2.30 p.m., reports; 5 p.m., parade and demonstration of electrical vehicles.
Friday, June 18th.—At 9.30 a.m., Council Meeting; at 10 a.m., Annual General Meeting.

NOTES.

Merchandise Marks Act Prosecution: Summonses Withdrawn.—Before Sir John Knill, at the Mansion House Police Court, on Wednesday, the British Thomson-Houston Co., Ltd., of Mazda House, Upper Thames Street, appeared to answer an adjourned summons charging them with having, on March 5th, unlawfully applied to the "one only electrophone," a certain false trade description, viz., the "one only B.T.H. Electrophone," contrary to the provisions of the Merchandise Marks Act (1887). A second summons charged the defendants with selling an electrophone to which a false trade description had been applied.

Mr. Bodkin, for the prosecution, said that, as the result of a consultation, the Alderman would not be troubled further with the case. Mr. Hammer, at whose instance these proceedings were brought, as the owner of the designs and patents which were mentioned on the last occasion, was advised, whether rightly or wrongly in law, that he was obliged to take these proceedings in order to prevent the further dispersal of these instruments, which contained his registered designs and patents, in order to preserve his rights therein, and to let it be generally known that he was not personally acquiescing in the dispersal or distribution of these instruments by way of sale. The defendant company fully appreciated this position, and they had made certain arrangements which were entirely acceptable to the prosecution. In view of this, he (Mr. Bodkin) would like to say that, so far as they were concerned, for the reasons he had indicated, there must not be any expressed or implied reflection upon the British Thomson-Houston Co., Ltd., for any part they had taken in the distribution of these articles. In the circumstances he asked leave to withdraw the summonses.

Mr. Hunter Gray, for the defence, said that, in the course of the last hearing, some question was raised as to the B.T.H. Co. having a factory in Berlin. This was not so. In point of fact these instruments came from an English company incorporated in this country, who have a branch in Germany. They were made by them and sent to the defendant company.

Mr. Bodkin: The question of a sub-contractor now explains the contradiction.

Sir John Knill: I am pleased, indeed, to hear what you have said. The summons will be withdrawn.

Fatalities.—Falkirk.—Sheriff Moffatt conducted an inquiry into the cause of death of John McClumpha, engineer, who was employed in No. 1 pit, Polmaise Colliery. It was stated that he met with his death while engaged in repairing an electric coal-cutting machine. When the repairs had been nearly completed the machine was set in motion before McClumpha got clear and he was caught by the teeth of the cutting disk, sustaining injuries which proved fatal on the spot. The jury returned a formal verdict in accordance with the evidence.

Kirkcaldy.—By falling from a gangway, James Philip (28), an electrician, was instantaneously killed while engaged in installing a system of electric lighting in the new cork mill of the North Linoleum factory, at Kirkcaldy. He was employed by Messrs. Melville, Robb & Scott, electrical engineers, Kirkcaldy.

Brighton.—According to the Press reports of the inquest into the death of Ernest Percy Belcher, aged seven, who was killed on Volk's (Brighton) electric railway, one of the directors said that strong wire netting was placed at two parts of the line, but youngsters brought pliers and cut it. Expert evidence was given to show that the maximum pressure never exceeded 170 volts. No accident like the present one had ever before occurred on the railway. The jury agreed that the line should be fenced on the south as well as on the north side, and that notices warning persons against crossing it at other than the recognised crossings should be erected. The company, it was stated, were prepared to do everything in their power towards making the railway safer. A verdict of "Accidental death through coming into contact with a live rail" was returned. There was no culpable negligence.

I.M.E.A. Development Committee. — At the last meeting of the Committee, held on April 16th, a report was received from the Publicity Sub-Committee on the work done with regard to a preparatory scheme for the production of printed matter on a co-operative basis.

Mr. Dunlop, on behalf of the B.E.A.M.A. Council, offered the use of offices and clerical assistance in connection with the routine work of purchase and distribution of such printed matter, at least during the early stages of the work, and the Committee expressed its appreciation of this offer.

It was resolved that Mr. Courtenay, of the General Electric Co., should act on the Publicity Sub-Committee in place of Mr. C. Palmer, at present on active service.

A report was received from the Electrical Installations Sub-Committee, and considered.

A report was also received from the Domestic Appliances Sub-Committee, outlining a preliminary scheme for certain technical investigations which the Committee hopes to put in hand at an early date.

The Committee recommended the inclusion of Mr. Shaw, of Worcester, and Mr. Wilmshurst, of Derby, as members of this Sub-Committee, also that from time to time members of manufacturing firms should be co-opted for advice and assistance in regard to specific objects which might be considered helpful to the work of the Development Committee.

In discussion it was pointed out that although depletion of staffs and restrictions placed on borrowing money must considerably hamper development work, yet there remained with most undertakings a large amount of new business to be obtained with very little expenditure, and therefore there still existed room for selective canvassing and publicity work which might be directed to helping manufacturers and traders under the present difficult conditions, if electricity supply were put forward more particularly in regard to power, on the strength of its real time and labour-saving advantages, and not merely as an improvement on existing conditions.

The Secretary reported the correspondence he had had with Mr. Wakeman, Society for Electrical Development, New York, and the Committee instructed him to thank Mr. Wakeman for material sent and offers of assistance and co-operation, which the Committee appreciated very much, and to express the hope that under more favourable conditions in the near future further development in this direction might become possible.

The next meeting will take place on June 16th.

Institution and Lecture Notes.—Physical Society of London.—At the meeting held on May 28th, a paper "On Numerical Relationships between Electronic and Atomic Constants" was read by Dr. H. S. Allen, and one "On a Method of Calculating the Absorption Coefficients of Homogeneous X-Radiation" was read by Mr. H. Moore.

Two experiments illustrating novel properties of the electron currents from hot metals were shown by Prof. O. W. Richardson. The first demonstrated the cooling of a tungsten filament when an electron current was allowed to flow from its surface. This effect is analogous to the cooling due to latent heat when a liquid evaporates, or to the similar phenomenon due to the heat of reaction when a gas is emitted by chemical decomposition of a solid.

The second experiment demonstrated the flow of electron currents from a hot filament to a surrounding cylinder against various opposing P.D.s up to about 1 volt. The data can be used to find the velocities of the emitted electrons.

A short account of recent experiments on High Permeability in Iron was given by Prof. Ernest Wilson.

Liverpool Engineering Society.—Prof. E. W. Marchant has been elected chairman for the coming year.

Association of Consulting Engineers (Incorporated).—The annual general meeting was held at Caxton Hall, Westminster, on Monday, May 31st, 1915, Mr. G. Midgley Taylor presiding. The chairman moved the adoption of the report of the Committee, and stated that the Association had recently elected several prominent engineers to membership, and from what could be gathered by conversation with consulting engineers generally, the Association was held in high esteem. It was evident that the Association occupied a very strong position, and in course of time, when its usefulness became better known, it was anticipated that it would include in its ranks the majority of the consulting engineers not only in Westminster, but also in the United Kingdom. One of the heaviest tasks undertaken by the Committee was a consideration of the Model General Conditions of Contract issued by the Institution of Electrical Engineers, to which considerable objection had been taken. It was felt that general conditions of contract should be applicable to contracts generally, and that works pertaining to the electrical branch of the profession should not require any special treatment. The objections were communicated to the Institution of Electrical Engineers, and the Association was thanked for its views.

During the past year the Book of Professional Rules and Scale of Fees had been revised, and, judged by the number of applications received for the book, not only from members of the Association, but from Government departments and the engineering profession generally, it had been found of great general utility.

Although membership of the Association was confined to principals of firms, there were no fewer than five of its members serving with His Majesty's Forces.

The adoption of the report was seconded by Mr. W. J. E. Binnie, and carried unanimously. The hon. treasurer, Mr. S. R. Lowcock, then presented his report, showing a balance in excess of expenditure of £65, compared with £13 last year.

Four London and two country members of the Committee having retired by rotation, the ballot for new members resulted as follows:—

The four London members elected were Messrs. W. Ll. Preece, W. J. E. Binnie, Ernest L. Mansergh, and E. Brough Taylor. The country members elected were Messrs. Walter Emmott (Halifax), and F. W. Hodson (Loughborough).

The report shows that six new members have been elected during the year, and the membership now stands at 74.

American Institute of Electrical Engineers.—On May 18th, Mr. John J. Carty, chief engineer of the American Telephone and Telegraph Co., was elected president of the Institute.

Electric-Light Switching Competition. — Messrs. A. P. Lundberg & Sons inform us that the overseas results of the competition or examination published in November last are as follows:—

Advance-Grade Certificate.—R. Drilhon, Pau (B.P.), France.

Intermediate-Grade Certificates.—H. Christall, London, Ontario; S. W. Ghosh, Calcutta.

Preliminary-Grade Certificates.—E. H. Asavaid, Bombay; P. N. Chiney, Bombay; J. J. Irani, Poona; J. Rustomji, Bombay.

Patents and Alien Enemies.—The Board of Trade has granted a licence to Messrs. R. S. Wright & E. E. Burnside in respect of Patent No. 25,101/12, granted to Bauer.

Alien Partners.—In a circular letter to the Press, Mr. Harold Benjamin draws attention to the case of Englishmen who have in partnership with them gentlemen, born alien enemies, who have become naturalised here; whilst most of these naturalised partners are men whose integrity is above all suspicion, the firms with which they are associated are suffering very much undeserved hardship as a consequence of the present strained feeling in commercial circles towards naturalised alien enemies. As a case in point, an Englishman is in a large way of business, in partnership for a term having many years to run with a German-born gentleman who has been in England a good many years and become naturalised, but whose name is strikingly Teutonic. Since the war, and particularly during the last month or so, the English partner has practically had to do all the work, and his partner remains more or less in retirement, but, nevertheless, is entitled to his moiety of profits, and such profits are being seriously affected as a result of other firms' disinclination to continue to do business with a firm having an Englishman in partnership with a former German. The English partner has it put plainly to him by important customers that they decline to do business with his firm solely on account of his partnership and the firm's name; it would not help matters to alter the firm's name so long as the partnership subsists, and it is a fact that Englishmen in such positions as the one mentioned stand to suffer heavy losses because they are saddled with partners who are, perhaps naturally, as it is their livelihood, disinclined to retire voluntarily.

If English partners in such circumstances put their heads together, Mr. Benjamin thinks they could address themselves to the Government on the subject, with a view to seeing whether some, and what, legal relief should be accorded.

Exhibition Space Contracts in War Time.—At the Westminster County Court on Monday, Lips, Ltd., lockmakers, sued Walter Cawood, Ltd., organisers of a Shipping and Engineering Exhibition which was to have been held at Olympia last year, and C. H. Luke and F. W. Bridges, organising managers, for the return of £9 paid as deposit for allotment of space at the exhibition and damages for the exhibition not being held. According to a report of the case appearing in the *Financial Times*, defendants did not agree to the postponement of the exhibition until 1916 or 1917. The defendants gave as one reason for the exhibition not being held in 1915, that exhibitors engaged on Admiralty and War Office work could not prepare suitable exhibits in time, but plaintiffs maintained that an exhibition this year would have attracted a great deal of attention, and would have been a very great success. Defendants said that the overwhelming majority of the exhibitors wanted the exhibition postponed. Judge Woodfall gave judgment for the plaintiffs for £9 and costs, with leave to defendants to appeal. In doing so, he said that he thought that the extreme probabilities were that the defendants had taken the wisest course, not only in their own interests, but in the interests of exhibitors. The question arose as to how far the outbreak of the war relieved one from the performance of a contract. So far as the law applicable to that problem was applicable to the present case, it was sufficient to say that because it made a burden and inflicted a hardship, that was not a ground to relieve defendants from their obligation.

Aluminium Solder.—Referring to the paragraph in our issue of March 5th on this subject, Mr. H. Grinlinton, of 243, Karangahape Road, Auckland, N.Z., informs us that Mr. Overend and he have made further progress, and can now solder any metals together by their process. Aluminium, or any other metal or alloy, can be soldered to cast-iron and other metals, and a variety of solders can be used. The process is applicable to aluminium cables, and tests are in progress to ascertain whether boiling water has any effect on such joints; at the time of writing no deterioration had been observed. Aluminium terminals, we are informed, can even be soldered direct on carbons, instead of casting lead tops on them. The statement that the Government had placed an order for 100 terminals was not correct, but the Government is inquiring into the merits of the process. We understand that the method can readily be taught to any mechanic in a few minutes. Mr. Grinlinton has sent us samples of the solder adhering to aluminium.

New Rays.—It is reported from New York that a new electrical ray, discovered by Mr. Charles Stanley, is being investigated by the Government Department of Health. It is claimed that Mr. Stanley's invention does all that it is possible for the X-rays to do, and more, because the surgeon would be able to seek for bullets in a wound without fear of burning. There is no danger to the operator or patient.

Professional Classes in War Time.—A meeting in support of the Professional Classes War Relief Council was held on the 1st inst., and was addressed by Sir John Simon and others. It was stated that the Council was spending £430 weekly; at the outset between £3,000 and £4,000 was subscribed, but the income was falling off, and unless the receipts were increased the work of the Council would come to an end within three months. At least £25,000 was needed to carry on the work in the coming year.

Appointments Vacant.—Electrical foreman (£280 +) for Federated Malay States Government Railway; foreman overhead lineman for Bolton Corporation Tramways; shift engineer (£2 7s. 6d.) for Warrington Corporation; resident assistant engineer (35s.+) for parish of Willesden. Particulars are given in our advertisement pages.

Volunteer Notes.—3rd Batt (Old Boys) Central London Regiment (Volunteers).—Battalion orders, by Colonel S. G. Grant (Officer Commanding).

Motor-Cars.—It is proposed to entertain wounded soldiers from various military hospitals next Sunday afternoon at Wembley Camp. Members desirous of lending their motor-cars for this purpose are requested to communicate immediately with the Adjutant, stating seating accommodation available.

Week-End Parades.

Saturday:—Route March. Battalion will parade at Baker Street Station at 2.30 p.m. Train to Wembley Park. Drums and bugles will attend. Note.—Particular attention will be paid to march discipline.

Sunday:—6 a.m. Reveille.
10 a.m. Church Parade.
10.20 a.m. Battalion Parade under Adjutant.
2.15 p.m. Battalion Parade under Commandant.

A. G. Joiner, *Captain and Adjutant.*

Educational.—Manchester Municipal School of Technology.—The Session 1915-16 will commence on October 5th. Matriculation and Entrance Examinations will be held in July and September. Further particulars are given in our advertisement pages to-day.

Inquiries.—Makers of celluloid boxes for accumulators, and the Helier battery, are asked for.

Prices Advance.—Messrs. Ercole, Marelli & Co., London, E.C., announce that, owing to the increase in the price of raw materials, all their prices are increased by 10 per cent.

Foreign Trade.—The May Figures.—The following are the electrical and machinery figures given in the official returns for May:—

	Month of May.	*Inc. or dec.*	*Five months, 1915.*	*Inc. or dec.*
Imports.	£	£	£	£
Electrical goods and apparatus, excluding machinery and uninsulated wire	87,588	— 39,269	371,300	— 308,944
Machinery ...	801,889	+ 64,466	3,453,720	— 1,565
Exports.				
Electrical goods and apparatus, excluding machinery and uninsulated wire	233,560	— 153,268	1,193,192	— 239,757
Machinery ...	1,830,300	—1,566,586	7,944,539	—8,426,634

Insulated Zinc Conductors.—It is reported that the use of zinc wire, insulated with regenerated rubber, has been sanctioned in Germany during the war, as a substitute for ordinary rubber-insulated copper leads for low-pressure installation work. Although having a lower conductivity, the insulated zinc conductors are declared to have proved to be a practical and appropriate substitute, and the Sales Bureau of the United Makers of Insulated Wires announces that deliveries are now available.

The Metric System.—The report of the Decimal Association for 1914 states that since the outbreak of the war public interest in the metric system has very greatly increased; many inquiries have been received by the Association, and several daily papers have advocated the adoption of the system. The trend of opinion is that if decimal coinage were adopted in this country, the public would soon demand a decimal system of weights and measures, and therefore the Association has resolved to give precedence to the question of coinage. On March 17th, 1915, the Association of Chambers of Commerce of the United Kingdom unanimously resolved that the immediate adoption of the metric system would be a valuable means of assisting British firms in their competition in countries where that system is in vogue. The metric carat came into force on April 1st, 1914, and has given general satisfaction; on May 1st, 1914, an absolute unit of barometric pressure and metric measurements of rainfall were adopted for official records. In the new British Pharmacopœia all weights and measures are given in the metric system. Further progress has been made in the use of the system in the textile industries.

British representatives abroad are pointing out the futility of issuing catalogues in terms of British weights and measures. The Committee of the British Society in the Argentine Republic unanimously holds that the most expeditious way to capture German trade in Latin-America would be the adoption of the decimal and metric systems. American Consuls are urging upon their country the urgent necessity of adopting the metric system. China has instituted a set of weights and measures based entirely on the metric system, the sole standards being the metre and kilogram.

The secretary of the Association, Mr. G. E. M. Johnson, is on active service with the Honourable Artillery Company.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. ALEX. MCINTOSH, who went from Edinburgh in 1900 as meter superintendent and consumers' clerk to the Woking Electric Supply Co., has now received the additional appointment of mains superintendent to the company. Mr. Jewell, who for the last 16 months has been mains superintendent to the company, has severed his connection with the undertaking.

It is announced that CAPT. GRAY, of the Howitzer Brigade, R.F.A., borough electrical engineer of Accrington, has become engaged to Miss Lillie Boyle, youngest daughter of the late Mr. Robert Boyle and Mrs. Boyle, of Blackburn.

The Gillingham (Kent) T.C. has increased the salary of MR. A. C. LINES, commercial assistant at the electricity works, to £140 per annum.

MR. R. W. KLITZ, the chief assistant of the borough electrical engineer, Wimbledon, has applied for leave of absence to enable him to join the Army for the duration of the war.

Conformably with his recent election, MR. ALAN A. CAMPBELL SWINTON was on June 3rd admitted a Fellow of the Royal Society.

The Bury T.C. has increased the salary of MR. S. J. WATSON, electrical engineer, from £550 to £650 per annum.

MR. F. C. LEESE and MR. A. E. LEESE, sons of Ald. Leese, who recently resigned their positions under the Stoke-on-Trent Electricity Committee, have been presented by their former colleagues with a Gladstone bag each. The presentations were made by Mr. C. Cuthbertson, resident engineer of the Stoke works, supported by Mr. S. G. Marston, mains superintendent for the southern area. Mr. F. C. Leese had been a mains inspector of the southern area for 11 years, and his brother had been a switchboard attendant for two years.

Tramway Officials.—MR. J. F. CAMERON has been appointed general manager of the Northampton Corporation Tramways, at a salary of £300 per annum, rising on approved service by two annual increments of £25 each to a maximum of £350. Mr. Cameron was formerly electrical engineer to the undertaking, but was appointed temporary manager six months ago following upon the dismissal, with £300 compensation, of the late manager, Mr. J. Gottschalk, who was of German birth. At Monday's meeting of the Town Council one member protested against the dishonourable way in which the Council was acting towards the late manager. He stated that it was held out to him that he would be able to apply for his old position after the war.

MR. G. H. MARGRAVE, chief clerk in the Northampton Corporation Tramways office, has resigned upon being appointed manager of the Wolverton Steam Tramway. MR. H. W. SYKES has been appointed chief clerk and MR. I. J. GEE second clerk at Northampton.

The salary of MR. F. BUCKLEY, the Wigan Corporation tramways manager, has been increased from £225 to £275 per annum, with a further advance next year to £300.

MR. J. C. WHITELEY, assistant manager and engineer to the Chatham and District Light Railways, has been appointed tramway manager by South Shields Corporation.

MR. SAUNDERS, acting manager of the Dartford tramways, met with a motor accident last week, and sustained, amongst other injuries, a fractured collar bone.

Consequent upon the deaths of Mr. W. C. Gordon, manager, and Mr. R. S. Tresilian, secretary, of the Dublin United Tramways Co., the directors have appointed MR. GEORGE MARSHALL HARRISS, chief electrical engineer, as general manager. MR. TAIMAN, a member of the electrical staff, has been appointed principal electrical engineer; and MR. BROPHY, who was principal assistant to Mr. Gordon, is appointed traffic manager. MR. MCHUGH, chief accountant to the company, succeeds to the secretaryship, and his principal clerk, MR. RATHBONE, becomes chief accountant.

General.—We mentioned in our last issue the names of several gentlemen upon whom distinction had been conferred in the King's Birthday Honours' List which appeared just as we went to press last week. These should be supplemented by the following:—

BARON READING is appointed a G.C.B. (additional), and BARON MOULTON a K.C.B. (additional) in the Civil Division, in recognition of services during the war.

WILLIAM PETERSON, Esq., L.L.D., C.M.G., Principal and Vice-Chancellor of McGill University, Montreal, is appointed to the Most Distinguished Order of Saint Michael and Saint George.

HUGH TROWBRIDGE KEELING, Esq., A.M.I.C.E., Chief Engineer and Secretary to the Chief Commissioner, Delhi, is appointed to the Most Exalted Order of the Star of India.

WILLIAM MAXWELL, Esq., C.I.E., M.V.O., Director-General of Posts and Telegraphs, is appointed to the Most Eminent Order of the Indian Empire.

ROBERT RICHARD GALES, Esq., A.M.I.C.E., Indian Public Works Department, Engineer-in-Chief, Hardinge Bridge, Sara, Bengal, receives the honour of Knighthood.

RAI CHUNILAL BASU BAHADUR, F.C.S., Teacher of Physics and Chemistry, and Fellow of the Calcutta University, is appointed to the Imperial Service Order.

RICHARD JOSHUA KEYS, Esq., Indian Telegraph Department, Deputy Superintendent, Traffic, Simla, is appointed to the Imperial Service Order.

In the *London Gazette* list of recent appointments under the Civil Service Commission, the following notices appear:—

Admiralty.—First assistant electrical engineer, HARRY HEWLETT RICHARD GREEN.

Admiralty.—H.M. Dockyards and Naval Establishments: Electrical mains and distribution supervisor, THOMAS HANDEL CAWTHRA; electrical station supervisor, H. W. G. J. JACKSON.

MR. HOWARD EADY, telephone manager for the Jersey District, who is leaving to take charge of the Exeter District, has been presented by the staff with an inscribed silver salver.

The Salford Board of Guardians has decided that, in consideration of the extra amount of work devolving upon MR. BOSTOCK, the engineer, and the able way in which he has carried out the work of relaying the electric cables between the administration block and the schools, he be granted an honorarium of £10.

COUNCILLOR WHITESIDE has been elected chairman of the Stretford Electricity Committee for the ensuing year.

The *Times* states that MR. J. G. B. STONE has been elected to fill a vacancy on the board of the Madras Electric Tramways (1904), Ltd., rendered vacant by the death of Mr. T. E. Ivens.

MR. WILLIAM SMITH, who has been Controller of Telegraphs at the General Post Office, Edinburgh, since April, 1911, has retired from the service after 45 years' connection with it. He is an authority on high-speed telegraphy, and sat on several committees in connection with telegraph improvements.

MR. SIDNEY FRANCIS SCHMID, electrician, of 30, Thorneycroft Street, Birkenhead, announces that by deed poll he has assumed the surname of Smith. He is a natural born British subject.

Obituary.—MR. R. W. SMITH SAVILLE.—The death occurred at Darwen on the 2nd inst. of Mr. R. W. Smith Saville, aged 47, who went to Darwen from Burton-on-Trent. He was responsible for many important undertakings, notably the electrification of the tramways, the laying of the tramways to Hoddlesden, and the completion of the electricity works. Up to three years ago he was joint manager of the tramways.

The *Times* records the death of SIR ARTHUR TREDGOLD LAWSON, chairman of the firm of Fairbairn, Lawson & Co., engineers, Leeds, at the age of 71 years.

The death occurred at Bolton recently, of MR. EDWIN WHITTAKER, who was at one time the superintendent of the Accrington tramways. He was with the Accrington tramway department during the time of the old steam locomotion, and for some time after the system was electrified.

The death has occurred in a Dublin hospital of MR. WALTER ORR MCILVEEN, chief clerk in the Belfast Corporation electricity department. Deceased was in his 39th year. He had been associated with the Belfast electricity undertaking for 20 years.

NEW COMPANIES REGISTERED.

Nordisk Electrical Power Co., Ltd. (140,530).—This company was registered on June 2nd, with a capital of £10,000 in £10 shares, to develop water and other powers for the production of electric, pneumatic, hydraulic or other power or force, to transmit, distribute and supply the same throughout the United Kingdom, Northern Europe, and elsewhere. The subscribers (with one share each) are: W. A. Cox, 6, Solva Road, Winchmore Hill, N., secretary; E. Cant, 102, Maidstone Road, New Southgate, N., accountant. Private company. The first directors are not named. Registered office: 18, High Street, Holborn, W.C.

Southdown Motor Services, Ltd. (140,534).—Registered June 2nd, by Jordan & Sons, Ltd., 116-17, Chancery Lane, W.C. Capital, £51,250 in 50,000 7½ per cent. non-cum. part. pref. shares of £1 each, and 25,000 deferred shares of 1s. each. Objects: to adopt an agreement with the Brighton, Hove & Preston United Omnibus Co., Ltd., Worthing Motor Services, Ltd., and the London & South Coast Haulage Co., Ltd., to acquire any tramway or light railway, and any trolley vehicle (being any mechanically-propelled vehicle adapted for use upon roads and moved by electrical power transmitted thereto from some external source), motor or other omnibus, ship, boat, aeroplane or airship, or motor or other cab undertakings in the United Kingdom or elsewhere. The signatories (with one preferred share each) are: W. F. French, 314, High Road, Balham, S.W., engineer; J. J. Clark, Goldstone House, Hove, director. Private company. The first directors (to number not less than two or more than seven) are Sir James Bradford, Kt., Alderman J. J. Clark, J.P., A. E. Cannon, A. D. McKenzie, W. F. French, and W. S. Wreathall. Qualification, 100 shares. Remuneration, £50 each per annum (chairman £25 extra). Solicitors: E. M. Marx & Colbourne, 62, Old Steine, Brighton.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Duram, Ltd.—Particulars of £20,000 debentures, created March 23rd, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £5,600. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Kingolite Co., Ltd.—Charge as additional security, dated May 14th, 1915, (supplemental to debenture dated July 9th, 1914, securing £400). Property charged: certain royalties. Holder: E. D. Taylor, [illegible] Heathwood Road, Stamford Brook, W.

Bournemouth and Poole Electricity Supply Co., Ltd. (55,189).—Capital, £500,000 in 25,000 ordinary, 7,500 4½ per cent. preference, and 17,500 6 per cent. 2nd preference shares of £10 each. Return dated April 1st, 1915. 15,000 ordinary, 7,500 4½ per cent. preference, and 17,500 6 per cent. 2nd preference shares taken up. £10 per share called up on 15,000 ordinary, 7,500 4½ per cent. preference and 15,000 6 per cent. 2nd preference, and £6 per share on 2,500 6 per cent. 2nd preference (new issue). £390,000 paid. Mortgages and charges: £187,500.

Madras Electric Tramways (1904), Ltd. (80,361).—Capital, £200,000 in £5 shares (25,000 pref.). Return dated April 6th, 1915. 20,000 preferred and 11,452 ordinary shares taken up; £5 per share called up on 13,500 preferred; £67,500 paid; £89,760 considered as paid on 6,500 preferred and 11,452 ordinary. Mortgages and charges: £59,540.

Eastern and South African Telegraph Co., Ltd. (13,306).—Capital, £600,000 in £10 shares. Return dated May 26th, 1915. All shares taken up; £600,000 paid. Mortgages and charges: Nil.

Brompton and Kensington Electricity Supply Co., Ltd. (25,913).—Capital, £300,000 in £5 shares (20,000 pref.). Return dated April 1st, 1915. 6,007 preferred and 33,993 ordinary shares taken up; £5 per share called up on 6,007 preferred and 32,993 ordinary shares; £195,000 paid; £5,000 considered as paid on 1,000 ordinary shares. Mortgages and charges: Nil.

British Electric Transformer Co., Ltd. (76,351).—Capital, £200,000 in £1 shares (100,000 pref.). Return dated April 2nd, 1915. 61,988 preferred and 85,498 ordinary shares taken up; £1 per share called up on 52,764 preferred and 9,529 ordinary shares, and 7s. 6d. per share on 14 ordinary; £62,298 5s. paid thereon; £15 12s. 6d. paid on 25 shares forfeited; £85,179 considered as paid on the remainder. Mortgages and charges: Nil.

Metropolitan Electric Supply Co., Ltd. (25,395).—Capital, £1,500,000 in 200,000 ordinary and 100,000 preferred shares of £5 each. Return dated March 30th, 1915. 200,000 ordinary and 76,121 preferred shares taken up; £5 per share called up on 195,936 ordinary and 76,121 preferred; £1,360,285 paid; £20,320 considered as paid on 4,064 ordinary. Mortgages and charges: £628,000.

British Insulated and Helsby Cables, Ltd. (52,285).—Capital, £1,000,000 in 100,000 preferred and 100,000 ordinary shares of £5 each. Return dated April 5th, 1915. All shares taken up. £5 per share called up on 74,470 preferred and 40,065 ordinary; £572,675 paid; £427,325 considered as paid on 25,530 preferred and 59,935 ordinary. Mortgages and charges: £700,000.

Northwich Electric Supply Co., Ltd. (46,958).—Capital, £35,000 in 25,000 ordinary and 10,000 preferred shares of £1 each. Return dated April 14th, 1915. 5,000 preferred and 18,525 ordinary shares taken up; £23,525 paid. Mortgages and charges: £10,810 4 per cent. debentures (part of £11,000 authorised).

County of London Electric Supply Co., Ltd. (34,320).—Capital, £1,600,000 in 80,000 preferred and 80,000 ordinary shares of £10 each. Return dated March 29th, 1915. 65,000 preferred and 65,000 ordinary shares taken up; £1,300,000 paid. Mortgages and charges: £1,000,000.

CITY NOTES.

Shropshire, Worcestershire and Staffordshire Electric Power Co.

MR. W. L. MADGEN, presiding at the annual meeting, held at Electrical Federation Building, W.C., on Monday, said that it was in 1914 that their electric supply business began to assume considerable dimensions. They were now supplying current for power, traction and lighting purposes in the boroughs of Smethwick and Dudley, also in the districts of Oldbury and Halesowen, while they held the principal share interest in the Kidderminster undertaking, which would, in due course, be connected up to the main system of supply. Their first main power station for the purposes of this supply was situated upon a suitable site on the canal at Smethwick, where they would have a plant capacity of 19,125 KW., including the extensions now approaching completion. The smaller generating stations at Dudley and Kidderminster were in a different category, and as developments required it, the smaller steam dynamos which they contained would be displaced by high-efficiency turbine sets of ample capacity to utilise to the best advantage the capital represented by the boiler plant, buildings, etc. Expenditure upon land, buildings, machinery, etc., at the close of the past year stood at £398,560, including £180,991 expended during the year. Much of their capital expenditure during the construction period had, of course, not yet fructified, but the business they had done enabled them to recommend a dividend of 3 per cent. The policy of the company in consolidating the electric supply in the district under one management promoted cheap production, distribution and administration, and thus enabled business to be done upon satisfactory terms. They were provided with a plant capacity and mains sufficient for dealing with a considerable increase in business, and looked forward to continued improvements in their returns. The Treasury had granted authority to issue £150,000 of preference shares or debentures, and arrangements were now in progress for the issue of this capital.

Mr. C. SHIRREFF HILTON seconded the adoption of the report, which was carried unanimously.

Gravesend & Northfleet Electric Tramways, Ltd.

THE annual meeting was held on Monday at Electrical Federation Offices, Kingsway, W.C. The report submitted showed that the revenue for 1914 was £20,807, as compared to £14,081, the increase being due to development of motor-omnibus services. After deducting all expenses, including repairs and maintenance, £1,800 for debenture interest, setting aside £1,250 for renewals fund, £5,464 remains, plus £879 brought forward There is to be placed to reserve £1,004, to reduction of commission on shares and debenture issue account £1,500, and after paying a year's preference dividend on the 6 per cent. cumulative preference shares to December, 1908 (£2,400), £1,439 is to be carried forward. £7,912 has been expended on capital account during the year, chiefly for motor-omnibus business. The capital is to be reorganised and the arrears of preference dividend from 1909 to 1914 dealt with, in order to put the company upon a sound basis to facilitate the raising of funds to provide for additional motor-omnibus business. A scheme was put before the annual meeting for cancelling the arrears of preference dividend and converting the holders' shares into an equal number of ordinary shares. In place of the late Mr. J. F. Albright, Mr. P. N. Gray has been elected a director.

United Electric Tramways of Monte Video, Ltd.

THE directors' report for the year to 31st March, 1915, gives the following results of the operation of the tramway system for the year to October 31st, 1914 (the fiscal year of the Uruguayan Co.):—

	1913-14.		Decrease.
Gross receipts	$1,698,885	...	$56,687
Operating expenses	1,033,942	...	11,999
Net receipts	664,943	...	44,688
At exchange of $4.7 to the £	£141,477	...	£9,508
Passengers carried	43,862,849	...	759,841
Car miles run	7,399,283	...	61,911
			Increase.
Percentage of operating expenses to gross receipts	60.86	...	1.28

The falling off in traffics was due principally to financial stringency throughout the whole of South America, accentuated in the latter months of the year by the European conflict, and to an abnormal rainfall and bad weather conditions during practically the whole year. The services also suffered interruptions in consequence of the municipal repaving works which were in progress during the greater portion of the period under review. The effect of the adverse conditions will be felt most heavily during the year now current, the receipts for which show a continuous decline. Although all possible care has been taken to counteract the decrease in receipts, and important economies in operation have been effected, the percentage of working expenses shows a further slight increase. This is more than accounted for by special expenditure necessitated by storms and floods, increase in maintenance charges, and discounting of nickel and silver currency. The construction and equipment of the two substations, referred to in previous reports, has been completed, and both stations are in operation, although the Diesel engines have not yet been taken over from the contractors. Owing to the high price of oil fuel, it has been decided for the present to operate the substations on Sundays and Feast days only, and in case of emergencies. The new Administration Office building having been completed, the officials and their respective staffs were installed there early in 1914. The amount receivable from La Sociedad Comercial de Montevideo in respect of revenue was £133,818. The profit and loss account for the year, after providing for administration expenses, and charging £48,850 for debenture interest, shows a credit balance of £77,035, making, with £12,641 brought forward, £89,676. There had been set aside for redemption of debenture stock £3,370, for redemption of the preference and ordinary share capital £2,500, and for renewals and contingencies £25,000. After paying 6 per cent. on the preference shares and 4 per cent. on the ordinary, £12,973 is to be carried forward.

Annual meeting, June 14th.

German South American Telegraph Co.

THE report of the Deutsch-Sud-Amerikanische Telegraphen Gesellschaft, of Cologne, for 1914, states that an increase in traffic and a considerable augmentation in the receipts took place in the first seven months, as compared with the corresponding period of the previous year. On August 5th, the cable between Borkum and Teneriffe was interrupted by the English, and two days later the station at Lome had to cease working. Nevertheless, it was possible to maintain the connection between Monrovia and Duala *via* Lome until August 9th. During the night of November 21st—22nd the cable between Teneriffe and Monrovia was also cut, probably by a British ship, whilst the wireless station at Monrovia was closed on September 1st, at the request of the Liberian Government. According to the agreement with the banking group, which is closely associated with the company, the directors took over in the course of the year, at the price of £105,600, the shares held by the group in the Compañia Telegráfico-Telefónica del Plata, of Buenos Aires. The Argentine company suffered in 1914 from the unfavourable economic conditions which prevailed in all South American countries, and which were aggravated by the outbreak of the war, and the accounts of this subsidiary company consequently closed with a slight loss for the year. The total receipts of the South American company, including the balance of £6,600 brought forward, amounted to £216,000, as contrasted with £219,000 in 1913. On the other hand, general expenses absorbed £44,900, as against £43,900, the cable renewal fund £15,600 as in 1913, the cable maintenance fund £30,300 as compared with £31,000, and depreciation £3,800 as against £7,600. The redemption of the cable network requires £11,300, as contrasted with £10,800, and the interest service on the loans of £1,046,000 needs a further sum of £47,000, as against £46,000 in 1913. As net profits, the accounts show the amount of £59,100, as against £62,600, and the dividend on the ordinary share capital of £625,000 becomes reduced from 6¼ per cent. in 1913 to 6 per cent. last year.

American Westinghouse Co.

Bradstreet's states that while the annual report of the Westinghouse Electric & Manufacturing Co. for the fiscal year ending March 31st, 1915, is silent on the point of the greatest public interest concerning that organisation, to wit, the amount and character of the orders for war material it has received from European countries, it is, nevertheless, a document which is entitled to attention. The income statement for the year compares with the figures of the preceding fiscal period as follows:—

Year ending March 31st.	1914-15.	1913-14.
Gross sales	$33,671,485	$43,733,646
Manufacturing costs	31,109,074	39,016,423
Manufacturing profit	2,562,411	4,717,222
Other income	1,158,527	1,280,856
Total income	3,720,939	5,998,078
Charges, depreciation, etc. ...	1,711,195	1,939,269
Balance	2,009,744	4,058,809
Preferred dividends	279,909	279,909
Common dividends	1,427,350	1,405,989
Surplus	302,485	2,372,911

The balance remaining after payment of charges, depreciation allowances (which item was $357,069) and preferred dividends, was equal to 4.63 per cent. on the $37,325,087 of common stock, against 10.73 per cent. earned on that class of shares in 1913-14. The report shows a large reduction in sales and profits, due not only to the unfavourable business conditions of last autumn and winter arising from the war, but to the strike in June and July, 1914, at the company's main establishment near Pittsburg. The value of the unfilled orders on March 31st, 1915, is given as $8,951,410, as compared with $7,951,385 at the end of the preceding year, and with $12,061,473 of orders on the books on March 31st, 1913. The visible improvement in the company's business is accordingly slight, but, as already mentioned, the report gives no facts as to the foreign war orders, which, according to general understanding, were not received and booked until within the month of April.

Electrical Power Storage Co., Ltd.

THE scheme for the amalgamation of the above company with Messrs. Pritchetts & Gold, Ltd., was approved at an extraordinary general meeting, held on June 3rd, at 4, Great Winchester Street, E.C. Mr. JAMES GRAY, who presided, first explained the reasons why the board had considered the proposal made by the firm mentioned. For some years the E.P.S. Co. had been seriously handicapped in London by rent, rates, and taxes, which were so much higher than in the provinces. During the last few years changes had been made in the management, and many economies effected, which had partly counteracted these drawbacks. Their principal drawback had been the lay-out and condition of their present works, which precluded the economical and rapid handling of goods necessary in these days of keen competition. They had come to the conclusion that the abandonment of the existing works was necessary, and negotiations for securing new works were proceeding when Mr. Pritchett approached the speaker with an amalgamation proposal. Messrs. Pritchetts & Gold could, at Feltham, provide accommodation for this company for a much lower outlay than they could have obtained new premises for themselves, and great economies could be effected by combining the two organisations. The larger shareholders had cordially approved of the provisional scheme for amalgamation, which was to take effect by the sale of substantially the whole of the property and assets of the company for shares and debentures of Pritchetts & Gold, Ltd. The company would retain its book debts and cash and discharge its liabilities. It would transfer to the amalgamated company (*a*) investments at market value; (*b*) its plant, tools and furniture, valued at the date of the agreement at £8,000; (*c*) its stock-in-trade upon terms; and (*d*) its patents, goodwill and benefit of contracts for £13,658. The purchase price would be satisfied by the issue of the following securities of the amalgamated company, viz.:—(*a*) £10,000 first mortgage debentures (part of an issue of £30,000) carrying interest at 5 per cent., payable half-yearly, and redeemable at par on June 30th, 1917, or at the option of the company, at any earlier date, with a premium of £5 per cent.; (*b*) 18,658 ordinary "B" shares of £1 each; (*c*) 4,000 deferred shares of 1s. each; and (*d*) preference shares or debentures for the balance. To carry the amalgamation into effect, it would be necessary for this company to go into voluntary liquidation, and the name of the amalgamated company would become "Pritchett & Gold and Electrical Power Storage Co., Ltd." The purchase price to be paid by Pritchetts & Gold, Ltd., would enable the debenture holders of the E.P.S. Company to receive an exactly equivalent amount of debentures of the amalgamated company, viz., £10,000, bearing the same rate of interest and redeemable on the same date as their present debentures. It was anticipated also that the liquidators would be enabled to distribute to the shareholders one 10 per cent. non-cumulative "B" ordinary share of £1 of the amalgamated company for every ordinary or founder's share of £5 of this company, and, in addition, one deferred share of 1s. of the amalgamated company, for every five ordinary or founders' shares of this company. The writing off of £4 per share was very drastic, but under the circumstances it was unavoidable. In the last balance sheet the item of patents and goodwill stood at £67,885, notwithstanding that the principal patents had long since expired. Moreover, a good deal of the plant and tools was now practically obsolete; in fact, they were valued at the date of the provisional agreement at £8,000. The capitalisation of Pritchetts & Gold, Ltd., was very conservative and having regard thereto, they considered the exchange offered to the shareholders of this company fair and reasonable. Indeed, they had in contemplation the writing down of the capital by £4 per share before this scheme of amalgamation was suggested, as it was quite apparent that no new capital could have been obtained for new works until this was done. The deferred shares of 1s. each were, so far as capital value was concerned, only nominal, but as they were entitled to the reversion of profits after paying dividends on the preference shares and the "A" and "B" ordinary shares, the deferred shares would, they expected, be of considerable value for dividend purposes. As indicated in the circular to the shareholders, however, a moiety of the dividend on the deferred shares to be issued to the shareholders of this company would be deferred up to a maximum of £5,000 until all obligations under maintenance contracts of this company expiring before December 31st, 1919, were exhausted. A similar indemnity had been granted by Pritchetts & Gold, Ltd., against their maintenance contracts, the proportion of dividend to be withheld being reduced in proportion to the smaller number of contracts which they had running. In regard to the position of maintenance contracts, it would be realised that until a fund was built up to provide for these contracts no part of the current manufacturing profits would be available for distribution. Under the scheme of amalgamation it was anticipated that the dividend on the "B" ordinary shares would be earned without difficulty, and after the indemnity of £5,000 against maintenance contracts had been provided there would be a very substantial dividend on the deferred shares, rendering these shares of real capital value.

The necessary resolutions were seconded by Sir JAMES PENDER and carried unanimously, Messrs. James Gray and W. A. Reid being appointed liquidators.

Middleton Electric Traction Co., Ltd.—The total revenue for 1914 was £18,557 and the expenditure £16,966, including £2,495 for debenture interest and £3,000 for renewals. After paying a dividend of 5 per cent. per annum on the cumulative preference shares for the half-year ended January, 1912, £619 is carried forward. Total capital expenditure, £160,045. Passengers carried, 2,958,738, as compared with 3,022,741 in 1913; average receipts per passenger 1·48d., as compared with 1·47d.; average working expenditure per passenger ·86d., as compared with ·92d. Proportion of expenses to receipts 59 per cent., as compared to 63 per cent. The annual meeting was held on Tuesday at Electrical Federation Offices, Kingsway, W.C.

Nairobi Electric Power and Lighting Co., Ltd.—It is announced that in consequence of the present irregularity and delays of mails from Nairobi, it will not be possible to present the accounts for 1914 until a later date. The Nairobi accounts are to hand, but certain other matter, necessary before the accounts are finally closed and printed, has not yet arrived. The directors have, however, declared a final interim dividend of 4 per cent. in respect of 1914 on both preference and ordinary shares, making 10 per cent. in all paid for the year. Special local conditions make it inadvisable for the board to declare an interim dividend for the half-year ending June 30th, 1915, payable promptly, and same will be deferred until the results of the half-year's working are known.

Devonport and District Tramways Co.—The annual meeting was held on Monday at Electrical Federation Offices, Kingsway, W.C. The directors reported that an agreement had been entered into for the sale of the tramways to the Plymouth Corporation as on October 2nd, 1915. The balance on revenue account for 1914 amounted to £8,831, which is to be distributed amongst the shareholders *pro rata* to their holdings.

International Light and Power Co., Ltd.—The directors recommend a final dividend of 1½ per cent., less British income-tax, on the preference shares for the final quarter ending June 30th, being 6 per cent. for the year.

Yorkshire (West Riding) Electric Tramways, Ltd.—An interim dividend of 3 per cent. (being at the rate of 6 per cent. per annum) on account of the dividend accrued on the 6 per cent. cumulative preference shares is announced.

Stock Exchange Notice.—The Committee has ordered the following securities to be quoted in the Official List:—

Waygood-Otis, Ltd.—Further issue of 15,000 ordinary shares of £1 each, fully-paid, Nos. 135,001 to 150,000; and 15,000 6 per cent. cumulative preference shares of £1 each, fully paid, Nos. 135,001 to 150,000.

Manila Electric Railroad and Lighting Corporation.—The directors announce a dividend of 1½ per cent. for the quarter ending June 30th.

New General Traction Co., Ltd.

The directors report that the revenue received and accrued during the year ended March 31st, 1915, amounted to £20,358. The general expenses, including directors' fees and legal charges, amounted to £1,893, and the debenture interest, less income tax, to £7,023. The profit was £11,059, plus £6,502 brought forward, making £17,561 available for distribution. The directors recommend a 4 per cent. dividend, absorbing £10,480, and £7,081 is to be carried forward. The accounts of the Norwich Electric Tramways Co. show that there was an increase in the traffic receipts for the year, but also an increase in the expenses. A dividend of 3 per cent. was paid by that company for the year ended June, 1914. The Douglas Southern Electric Tramways, Ltd., paid 1½ per cent. on its preference shares in respect of the year ended October, 1914. The outbreak of war was responsible for the great decrease in traffic receipts. The income received from the Philadelphia undertaking for the year ended December, 1914, amounted to £13,912.

Annual meeting, June 15th.

Barcelona Traction, Light and Power Co., Ltd.—

At a meeting of 5 per cent. first mortgage bondholders, held in London on Tuesday, an agreement was approved for the creation and issue of 7 per cent. prior lien bonds and for modifying the terms of the trust deed.

STOCKS AND SHARES.

Tuesday Evening.

There remains a general air of lassitude over prices, and business does not give much indication of material improvement. At the same time, there is a little going on in some of the departments of the Stock Exchange, and a welcome recovery has occurred in the price of Brazilian Tractions. On the other hand, an outstanding feature is provided by a further slump in the Income bonds of the Electric Railways, and this has had the effect of depressing both classes of shares in the same company. Stock Exchange rumour insists that the passage of the Dardanelles has been already forced, but that the Admiralty prefer to keep silence on the point at present.

The Rio de Janeiro rate of exchange has moved up sharply to 12 7/16d. after touching 1s. per milreis. That there should be some sort of reaction was natural enough, though it seemed so long in coming that people with Brazilian securities have been getting frightened, and it required but a small amount of pressure to sell for the price of Brazil Tractions to crumble noticeably. The price has been down to 49½, but is now 4 points higher; and the rally in the exchange has revived hopes that the dividend may be maintained at its regular 6 per cent. level. Some people seem to think that it would not be at all a bad thing if the directors decided to lower the dividend, if only to save the quarterly uneasiness which worries shareholders when the date of dividend declaration draws near. Certainly there is ample excuse for the directors to plead prudence in reducing the dividend from its present comparatively high figure.

The further fall of 6½ points in Underground Electric Income bonds affects a wide circle of investors; and since there is no apparent reason for the drop, some of the holders are beginning to get more than a little anxious. It is fresh in the mind of everybody that Sir Edgar Speyer just lately resigned his position as chairman of the company, so, of course, the supposition is advanced that he may have been wishing to realise some of his bonds and shares. This is sheer guesswork, and we must admit that to us it sounds a little improbable, because, putting it on its lowest ground, Sir Edgar Speyer's firm is so intimately connected with the Underground Electric Railways Company that selling from his personal account would depreciate the firm's holdings—and, as we have pointed out before, the limited character of present-day markets renders them particularly susceptible to a mere modicum of buying or selling.

It is obvious enough that the London General Omnibus Company must be doing extremely well, but the District Railway and other Tubes cannot be making much profit at present. With so little known data to work upon, it is difficult to form reliable opinions about the security of these particular bonds; but, having regard to the acute nature of the fall, and the fact that, so long as they get their full interest, the return on the money invested at the present price comes to nearly 10 per cent., making allowance for the fact that the coupons are paid free of tax, some sort of a recovery does seem likely to take place.

Notwithstanding the slightly dull tone which envelops investment markets, it is still none too easy to pick up stock in certain markets. We have referred over and over again to the difficulty that exists in obtaining good-class electrical issues, and, in view of this, it may be of some use to set out a selection of a few bonds and stocks which can be actually bought at the present time. Even in the following cases there are several in which the amount of stock on offer is limited to a few hundred pounds, but we submit them in order to show the yields obtainable from securities on offer at the present time:—

Stock and Bonds.	Price.	Yield.	Dividends due.
Anglo-Argentine Trams 4 per cent. Deb. ...	84	4 15 0	Jan., July
Anglo-Argentine Trams 4½ per cent. Deb. ...	90	5 0 0	Jan., July
British Columbia Electric Railway 4½ per cent. Cons. Deb.	80	5 6 0	Mar., Sept.
British Columbia Electric Railway 5 per cent. Pref.	75	6 13 0	Jan., July
British Electric Traction 4½ per cent. 2nd Deb.	75	6 0 0	May, Nov.
B.A. Lacroze Tramways 5 per cent. Extension Mort. Debs.	90	5 11 0	June, Dec.
Met. Electric Supply 3½ per cent. Mort. Deb. ...	76	4 12 0	Jan., July
Rio Tram 5 per cent. 1st Mort. 30-year Gold ...	94	5 9 0	Jan., July
Rio Tram 5 per cent. 50-year	80	6 5 0	April, Oct.
South American Light & Power 5 per cent. Debs.	90	5 11 0	April, Oct.
South Met. Elec. Light 4½ per cent. 1st Mort. Deb.	95½ free	4 14 0	April, Oct.
Toronto Power 4½ per cent. Con. Guar. Deb. ... (Guaranteed by Toronto Railway Co.)	88½	5 2 0	May, Nov.
Vancouver Power Co. 4½ per cent. Deb. ... (Guaranteed by British Columbia Elec. Rly.)	78	5 9 0	Jan., July
Winnipeg Elec. Rly. 4½ per cent. Deb.	89 free	5 1 0	April, Oct.

The Electricity Supply list is disposed to droop, this applying both to the ordinary and the preference shares. City of Londons have given way to 13¾, a drop of 10s. Westminsters fell 5s., and so did Charing Cross. This, of course, is the season of the year in which illumination shares are completely out of favour; and the weakness is noticeable in gas stocks, just the same as in some of the electric light descriptions.

(How bloodthirsty the ordinary pacific Englishman can become may be instanced by the remark of a member of the National Guard returning from trench-digging at the beginning of the week, when he said, as the train passed the power station of the Charing Cross Company, that if a Zeppelin were to aim at that and, missing it, to strike a prisoners' camp near by, he, for one, would shed no tears. But this, it must be added, was at the end of a very hot day; and the effect of trench work upon the temper during the weather experienced in the first part of the week, it were best left to the wives of some of us to describe.)

The Mexican group continues flat. Mexican Trams fell 3, the 6 per cent. bonds 2 points. Depreciation of the currency is the worst-feared result of the revolution. Germany seems to be marching much the same path as is Mexico in this matter, and neutral manufacturers are already declining German bills, insisting upon payment in gold. It is all very well for German financiers to clash the loud cymbals about the credit of their country, and so long as trade is confined purely to internal channels, the paper manufacturers can work day and night without the country feeling much damage. But when it comes to trying to pass this sorry stuff along to other nations, there will be a different tale to tell. And it is plain as a pike-staff that, when the day of reckoning arrives after the war, there will be literally hundreds of German houses go smash, for lack of gold, as distinct from paper money.

The Telegraph market is a little irregular. Great Northerns have again advanced, a rise of £2 taking the price to 3. Globes are unaffected by the declaration of a final dividend on the ordinary, bringing the total distribution for the year up to 6 per cent., the same as before. Marconis are decidedly better, on dividend anticipations, and American Marconis strengthened to half-a-guinea.

Callenders eased off to 12¼, and small falls have occurred in Edison & Swan and British Westinghouse preference shares, while Aluminiums are 6d. higher. The Rubber market shows a good deal of quiet strength as the price creeps up steadily towards the level half-crown. Armament shares have advanced a trifle, owing to the insistent demand for munitions; and most of the copper shares are good, on account of the buying from the United States.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£		£	£		Inc.
Blackpool-Fleetw'd	May 29	2,702	+ 868	21	8,776	— 241	8	..
Bristol	„ 28	42,133	+8,138	21	190,392	+21,378	30·5	..
Chatham and Dist.	„ 27	4,901	+1,412	21	29,100	+ 3,782	14·98	..
Cork	„ 27	2,198	+ 301	21	9,853	— 196	54·25	..
Dublin	„ 28	25,515	+1,905	21	123,868	+ 7,355	9·89	..
Hastings	„ 27	3,981	+ 329	..	..	— 364	19·3	..
Lancashire United	„ 26	7,185	+ 588	21	33,660	— 66	42	..
Llandudno-Col. Bay	„ 28	1,479	+ 529	25	6,533	+ 1,282	6·5	..
Tyneside	„ 26	2,642	+ 527	21	11,436	+ 454	11	..
Anglo-Argentine ..	„ 27	213,701	—7,698	21	1,082,097	—100,175	..	..
Auckland	„ 7	20,447	—1,891	44	227,598	+ 1,206	25·42	1·08
Calcutta	„ 28	16,715	— 444	..	..	— 444	..	..
Kalgoorlie, W.A. ..	March	2,688	..	13	7,362	..	..	..
*Madras	May 31	1,948	+ 97	21	19,087	— 244	..	..
Montevideo ..	May	27,771	—1,245	30	202,426	—26,771	..	..
Dublin-Lucan Rly.	May 28	676	+ 94	21	2,864	+ 146	7	..

* Two weeks.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend, 1914.	Price June 8, 1915.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.				
Brompton Ordinary	10	8½	—	£6 1 8
do. 7 per cent. Pref.	7	7¼	—	4 10 4
Charing Cross Ordinary	5	4½	— ¼	5 17 8
do. do. do. 4½ Pref.	4½	4⅜	—	5 9 1
do. do. City Pref.	4½	4	—	5 12 6
do. 4 Deb.	4	90	—	4 9 0
Chelsea	5	4⅝	—	5 8 1
do. 4½ Deb.	4½	92	—	4 17 10
City of London	9	19⅜	— ½	6 11 0
do. do. 6 per cent. Pref.	6	12¼	—	4 18 0
do. do. 5 Deb.	5	113	—	4 9 8
do. do. 4½ Deb.	4½	96	—	4 13 10
County of London	7	11⅜	—	6 3 1
do. do. 6 per cent. Pref.	6	11½	—	5 4 4
do. do. 1st Deb.	4½	100	—	4 10 0
do. do. 2nd Deb.	4½	95 xd	—	4 14 9
Kensington Ordinary	9	7	—	6 8 7
London Electric	4	1½	—	8 0 0
do. do. 6 per cent. Pref.	6	5	—	6 0 0
do. do. 4 Deb.	4	87	—	4 12 0
Metropolitan	8½	8½	—	5 12 5
do. 4½ per cent. Pref.	4½	4	—	5 12 6
do. 4½ Deb.	4½	94	—	4 15 9
do. 3½ Deb.	3½	74	— 1	4 12 0
St. James' and Pall Mall	10	7½	—	6 13 4
do. do. do. 7 per cent. Pref.	7	6⅝	—	5 9 10
do. do. do. 3½ Deb.	3½	76	—	4 13 4
South London	5	3	—	6 13 4
South Metropolitan Pref.	7	1½	—	6 4 5
Westminster Ordinary	9	7¼	— ¼	6 4 2
do. 4½ Pref.	4½	4⅛	— ⅛	4 14 9
Telegraphs and Telephones.				
Anglo-Am. Tel. Pref.	6	105	—	5 14 4
do. Def.	1½	22½	—	6 13 4
Chile Telephone	8	6⅝	—	5 18 5
Cuba Sub. Ord.	5	8⅝	—	5 17 8
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	13	—	*6 1 3
do. 4 Deb.	4	91	—1	4 8 0
Eastern Tel. Ord.	7	132	—1	*6 1 4
do. 3½ Pref.	3½	76	+1	4 12 1
do. 4 Deb.	4	91	—1	4 8 0
Globe Tel. and T. Ord.	6	11	—	*6 4 9
do. Pref.	6	11⅜	—	5 2 2
Gt. Northern Tel.	22	33	+2	6 13 4
Ind.-European	65/-	54	—	6 0 4
Marconi	20	19⅞	+ ⅛	10 16 2
New York Tel. 4½	4½	97	—	4 13 0
Oriental Telephone Ord.	10	2	—	5 0 0
do. Pref.	6	1⅛	—	5 1 1
Tel. Egypt Deb.	4½	88	—	5 2 3
United R. Plate Tel.	8	6½xd	—	*7 7 0
do. Pref.	5	5	—	5 0 0
West India and Pan.	1	1½	—	8 0 0
Western Telegraph	7	13½	—	*5 18 5
do. 4 Deb.	4	91	—	4 6 6
Home Rails.				
Central London, Ord. Assented	4	77	—	5 4 0
Metropolitan	1½	29	—	4 7 2
do. District	Nil	16	— ⅜	Nil
Underground Electric Ordinary	Nil	1½	—7/6	Nil
do. do. "A"	Nil	4/-	—1/8	Nil
do. do. Income	6	70	— 6½	*9 12 10
Foreign Trams, &c.				
Anglo-Arg. Trams, First Pref.	5½	4⅝	—	6 5 9
do. 2nd Pref.	6½	8⅝	—	7 6 8
do. 4 Deb.	4	84	+1	4 15 0
do. 4½ Deb.	4½	87	—	5 3 6
do. 5 Deb.	5	87xd	—	5 15 0
Brazil Tractions	6	53⅛	+3⅛	11 4 4
Bombay Electric Pref.	6	10⅝	—	5 16 10
do. 4½ Deb.	4½	91	—	4 19 0
Mexico Trams	Nil	32	—3	Nil
do. 5 per cent. Bonds	—	58	—	Nil
do. 6 per cent. Bonds	—	90	—2	Nil
Mexican Light Common	Nil	20	—	Nil
do. Pref.	Nil	39	—	Nil
do. 1st Bonds	—	48	—	—
Adelaide Sup. 6 per cent. Pref.	6	5⅞	—	5 18 0
do. 5 Deb.	5	103	—	4 17 1
Manufacturing Companies.				
Babcock & Wilcox	14	2½	—	5 12 0
British Aluminium Ord.	5	21/6	+6d.	4 13 0
do. Pref.	6	1⅝/6	—	6 9 9
British Insulated Ord.	15	11½	—	6 13 4
do. Pref.	6	6⅞	—	5 0 0
British Westinghouse Pref.	7½	1¼	— 1/8	8 0 0
do. 4 Deb.	4	72	—	5 11 1
do. 6 p. lien	6	101	+	5 19 0
Callenders	15	12½	— ½	6 3 8
do. 5 Pref.	5	5	—	5 0 0
do. 4½ Deb.	4½	98	—	4 12 4
Cartner-Kellner	15	8½	—	4 12 6
Edison & Swan, £3 pd.	Nil	12/6	—3d.	Nil
do. do. fully paid	Nil	1⅞	—	Nil
do. do. 4 Deb.	4	63	—	6 7 0
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	13/-xd	—	9 4 8
do. do. Pref.	7	1xd	—	7 0 0
Gen. Elec. Pref.	6	10⅜	—	5 17 8
Henley	20	14½	—	*8 0 4
do. 4½ Pref.	4½	4¼	—	4 12 4
do. 4½ Deb.	4½	97	—	4 14 9
India-Rubber	5	9	—	5 11 1
Telegraph Con.	20	87	—	6 9 10

* Allowance made for dividends being paid free of income-tax.

Western Telegraph Co., Ltd.—The directors have declared the third quarterly interim dividend of 3s. per share, free of income-tax, for the year ending June 30th, 1915, being at the rate of 6 per cent. per annum.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, June 9th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric per cwt.	4/6	..
a „ Nitric „	19/-	..
a „ Oxalic per lb.	..	..
a „ Sulphuric per cwt.	..	..
a Ammoniac Sal „	£49	..
a Ammonia, Muriate (large crystal) per ton	£40	..
a Bleaching powder „	£9	..
a Bisulphide of Carbon „	£21	..
a Borax „	£22	..
a Copper Sulphate „	£29	..
a Lead, Nitrate „	£35	..
a „ White Sugar „	..	..
a „ Peroxide „	..	..
a Methylated Spirit per gal,	7d.	..
a Potassium, Bichromate, in casks per lb.	..	..
a Potash, Caustic (88/90 %) per ton	..	..
a „ Chlorate per lb.	1/6	..
a „ Perchlorate „	1/6	..
a Potassium, Cyanide (98/100 %) „ (for mining purposes only)	Nom.	..
a Shellac per cwt.	65/-	..
a Sulphate of Magnesia per ton	..	..
a Sulphur, Sublimed Flowers „	£11 10	..
a „ Recovered „	£8	..
a „ Lump „	£8 10	..
a Soda, Caustic (white 70/72 %) „	£10 2 6	..
a „ Chlorate per lb.	10½d.	..
a „ Crystals per ton	45/-	..
a Sodium Bichromate, casks per lb.	8¼d.	..
METALS, &c.		
b Aluminium Ingots, in ton lots per ton	£100	£5 inc.
b „ Wire, in ton lots (1 to 14 S.W.G.) „	£130	£5 inc.
b „ Sheet, in ton lots „	£130	£5 inc.
p Babbitt's metal ingots „	£50 to £221	..
c Brass (rolled metal 2" to 12" basis) per lb.	1/2 to 1/2½	..
c „ „ (solid drawn) „	1/2½ to 1/2¾	..
c „ Wire, basis „	1/2¾ to 1/3	..
c Copper Tubes (solid drawn) „	1/1½ to 1/2	..
g „ Bars (best selected) per ton	£104	£4 inc.
g „ Sheet „	£104	£4 inc.
g „ Rod „	£104	£4 inc.
d „ (Electrolytic) Bars „	£93	£3 inc.
d „ „ Sheets „	£110	£3 inc.
d „ „ Rods „	£98	£3 inc.
d „ „ H.C. Wire per lb.	11 5/16d.	1/16d. inc.
f Ebonite Rod „	8/-	..
f „ Sheet „	2/6	..
n German Silver Wire „	1/9	..
h Gutta-percha, fine „	6/10	..
h India-rubber, Para fine „	2/7	½d. dec.
l Iron Pig (Cleveland warrants) per ton	65/4	10d. inc.
l „ Wire, galv. No. 8, P.O. qual. „	£22	£2 inc.
g Lead, English Pig „	£27 5	£6 10 inc.
m Manganin Wire No. 28 per lb.	..	..
g Mercury per bot.	£15	£3 inc.
c Mica (in original cases) small per lb.	4d. to 2/6	..
c „ „ „ medium „	3/- to 5/-	..
c „ „ „ large „	6/6 to 10/6 & up.	..
o Nickel, sheet, wire, &c. „	Nom.	..
p Phosphor Bronze, plain castings „	1/1 to 1/3½	..
p „ „ rolled bars & rods „	1/2 to 1/3½	..
p „ „ rolled strip & sheet „	1/3½ to 1/5½	..
o Platinum per oz.	185/-	..
d Silicium Bronze Wire per lb.	1/1	..
r Steel, Magnet, in bars per ton	£80	..
g Tin, Block (English) „	£167	£3 inc.
n „ Wire, Nos. 1 to 16 per lb.	2/8	..
p White Anti-friction Metals per ton	£52 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.) „	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

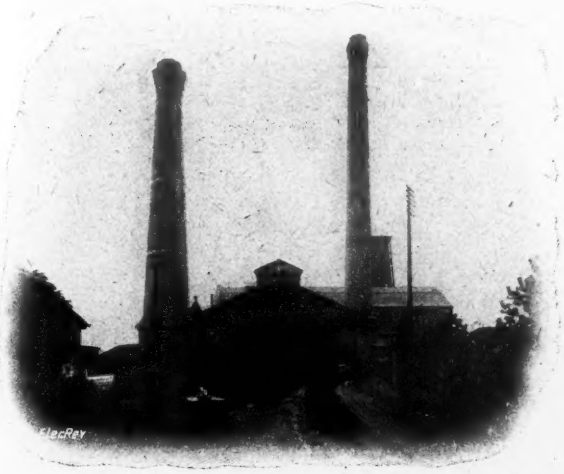
Lift Accident.—A Manchester Coroner's jury inquired on Friday last into the circumstances of the death of Mordecai Reynolds (14), who received fatal injuries in a lift accident at the premises of the Provincial Incandescent Fittings Co., where he was employed. It appeared from the evidence that the boy had been placing parcels in the lift, which was electrically-worked, and a warehouseman on the third floor heard a scream and saw the lift ascending empty. He went downstairs and found the boy in the well of the lift. The warehouseman thought that the boy must have slipped while putting the parcels into the lift and grasped the starting lever to save himself, or else his coat had caught the handle. The manager said the lift was not in constant use, and anybody could use it, but he had instructed the deceased not to use it, and had reprimanded him three weeks before the accident when he found him in it. "Accidental death" was the verdict.

Rees Roturbo Manufacturing Co., Ltd.—The accounts for 1914 show a profit of £1,570, and after meeting interest on loans, the credit balance of £2,539 brought forward was reduced to £413.—*Financier.*

ELECTRICITY IN FARMING.—II.

FARMING SUPPLY AT HEREFORD.

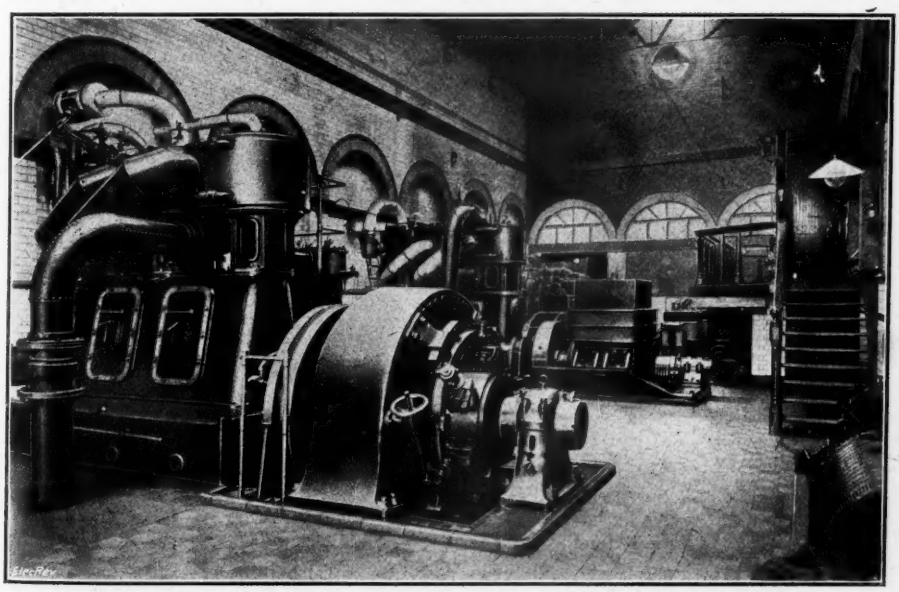
If convincing evidence as to the value of electricity in agriculture is to be put before our supply engineers—those who are in touch with farming districts—it will no doubt come better from within than without, and we are glad to be able to give some details of the work carried out by an English central station engineer, Mr. W. T. Kerr, of Hereford, in meeting the electrical requirements of the farmers in the vicinity of his city, and of the general supply



The Hereford Electricity Works

in Hereford, which is a typical agricultural centre, in the hope that the excellent results obtained may be an incentive to others.

In the first place, we may point out that the electricity works, which started in 1898-99, now contain some



Steam Generating Plant installed at Hereford.

850 kw. of generating plant supplying a net area of seven square miles. This plant consists of Belliss-Dick Kerr and Belliss-Silvertown 500-volt generating sets—the most recent one a 300-kw. plant—with surface condensers working in conjunction with a Blasberg cooling tower and giving a 25-26 in. vacuum.

A 300 ampere-hour Chloride battery and balancer-booster are provided.

Steam is supplied at 160 lb. pressure from one Stirling and two Lancashire boilers, which are fitted with Underfeed stokers, and provided with heated forced draught. The gases from the boilers are passed through an economiser,

Transmission Line for Farm Supply.

and both steam and electrically-driven feed pumps are installed. The presence of the older plant in the station has prevented the adoption of superheating up to now.

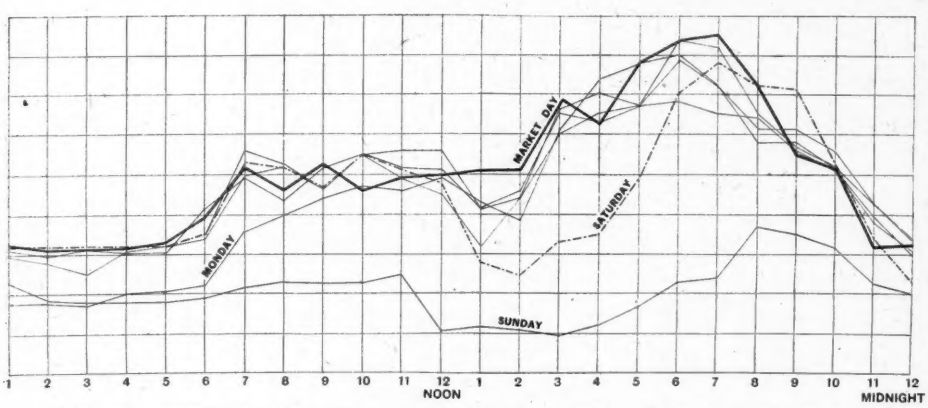
Through the electrical development of this agricultural area, containing possibly 25,000 inhabitants, with, however, no factories, electric street lighting or tramways, over 1,300,000 units were sold during the last 12 months, and a load factor of 25½ per cent. was obtained, figures which speak for themselves.

Under these conditions the generating plant operates on some 5 lb. of fuel (at a cost of ·38d.) per unit, a mixture of slack and coke breeze being used at present owing to the coal crisis, and the overall steam consumption being, roughly, 30 lb. per unit.

The distributing network extends practically two miles out in every direction from the station, and while the built-up area is naturally supplied through underground cables, it has, of course, been necessary to adopt overhead pole lines for supplying the farmer and other scattered consumers outside this area. For this purpose some three miles of overhead line has been constructed, with fairly light wooden poles carrying two stranded-aluminium conductors on the upper cross-arm, and two galvanised iron

guard wires—which serve as the neutral wire—on the lower arm.

At terminal poles adjoining the underground network the three-core armoured cable is carried to a dividing box at the top of the pole, the bare cable ends being joined to the overhead aluminium wires mechanically by means of Silvertown service joint connectors; at farm terminal poles Henley twin lead-covered wire, cleated to the pole and farm buildings, is used to couple the line and farm installation. Mr. Kerr gives the actual cost of such a line carrying two 7/10 stranded aluminium conductors and two guard-wires, erected in compliance with Board of Trade Regulations, as £110 per mile under normal conditions.



CURVES SHOWING VARYING DAILY LOAD FOR ONE WEEK; HEREFORD ELECTRICITY WORKS.

It is the practice to place such pole lines along the hedges where they are out of the way of cattle and field operations generally, and occasionally wayleaves for poles are demanded, of the order of 1s. per pole per year, where the owner of the land is not directly interested in the supply. So far, we gather that no maintenance has arisen on these lines, some of which have been in use for some years.

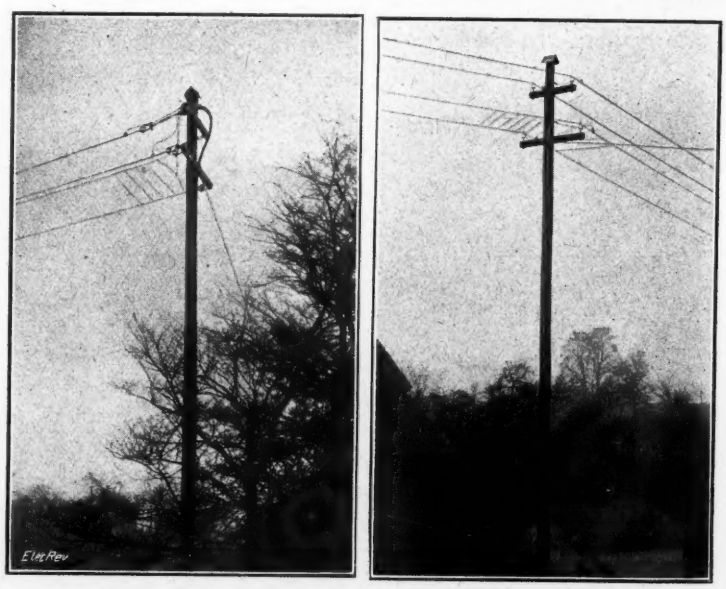
Mr. Kerr is at present supplying 10 actual farms, and we may refer to a typical case of one where from 80 to 100 cows are kept. Here a 7½-H.P. motor is, following a general practice, installed in a locked-up cupboard or cabin, and drives chaff-cutting, kibbling and pulping machines for preparing cattle food, and a small pump for supplying water; electric light is installed in the byers, foal yards and house, about 30 metal lamps being used, including four 50-C.P. lamps in a bracket fitting for general yard lighting.

This consumer took 633 units last year for lighting, at 4½d. per unit, and 930 units for power, at 3d. per unit, less usual discounts, and gave the supply undertaking a revenue of over £23 for the year, and Mr. Kerr estimates the average farm bill in his area at £20 per annum.

It will be noted that both the cost of overhead lines and the average revenue are higher than those indicated in the American figures, while the cost of energy is — allowing for American values — cheaper here, the results showing that the English farmer is likely to prove a better customer than the American.

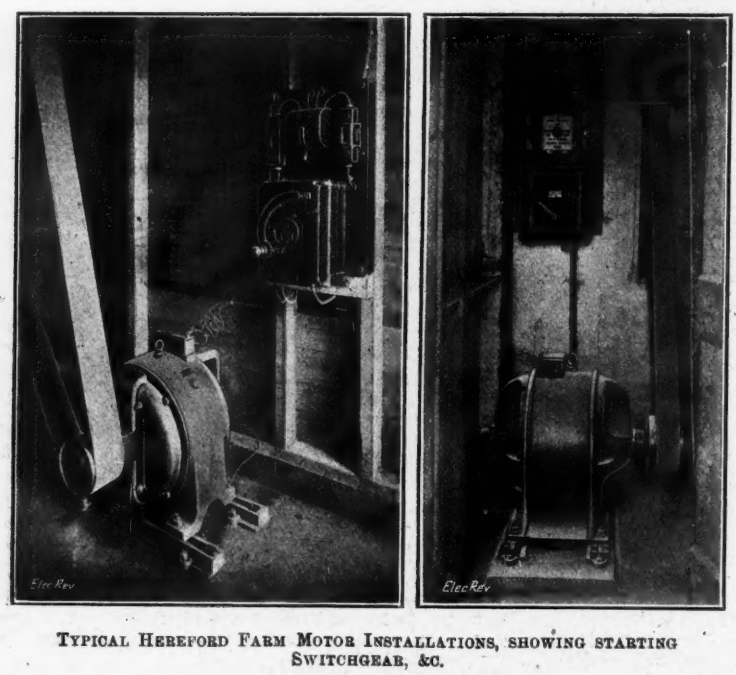
Moreover, Mr. Kerr considers it quite feasible to obtain an average revenue of at least £200 per annum per mile of line from farms and country houses.

Such a line, 1,000 yards long, was recently constructed to supply a farm where power is used in the manner previously indicated, and for milking 88 cows, and the electrical stimulation of root crops, &c., as an experiment, on some 20 acres of land, during the early morning and evening is under consideration, by means of apparatus controlled through a time switch; this line has attracted two other farms and two private houses *en route*, and it is found that *through the encouraging results every farmer will do all he can to get a supply*, and if necessary use his influence with the local Councils, which



Underground Cable Terminal. Farm Terminal.

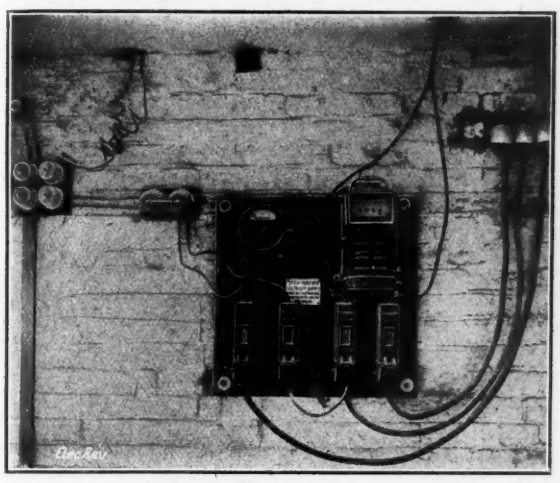
TERMINAL POLES ON FARM LINES.



TYPICAL HEREFORD FARM MOTOR INSTALLATIONS, SHOWING STARTING SWITCHGEAR, &C.

at first were strongly inclined to put difficulties in the way—following time-honoured precedents.

"Such prices as 6d. per unit for lighting and 3d. per unit for power are quite acceptable to the farmer in this area,



Farm Terminal Board and Incoming Cables.

who gains in many ways by using electricity. Thus the first cost of his installation is probably not more than half

Overhead Wiring and Lighting in a Hereford Farmyard.

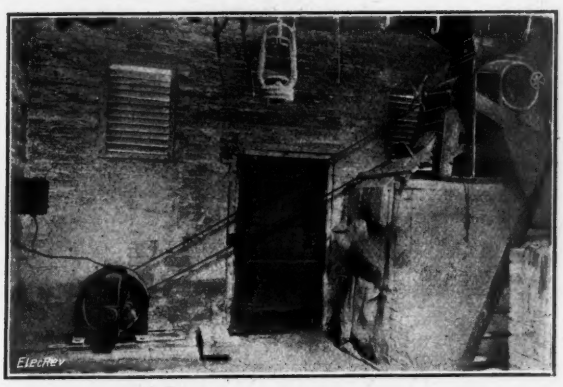
that for steam or oil power. His fire insurance is greatly reduced, especially where power is used in a stack yard, in which case insurance may be as costly as the power itself with a steam engine.

His labour costs less; the electric motor is always ready, and on a wet day, when outside labour is impossible, chaff-cutting and corn kibbling can be done; moreover, milking machinery is being found essential. The freezing of water in the cylinder jackets or the necessity of emptying them is against the internal-combustion engine in the winter, while magneto and other starting arrangements are scarcely suited to farm usage, and it is not surprising that starting troubles are the bane of this type of prime mover on the farm.

As a sequel it may be mentioned that *there are no petrol engines on farms in the vicinity of the Hereford distributing mains.*

To some extent recent legislation, in the shape of the Pure Milk Bill, has encouraged the use of electricity for lighting and power in cowhouses, which are being largely reconstructed in certain parts of the country, giving a convenient opportunity for installing electrically-driven food preparing machinery close to the cattle stalls, and of cutting fresh food every morning and afternoon of the week, when the cattle are fed, this having been found by experience to give an increased yield of milk.

Supply to an outlying farm is usually granted on a revenue guarantee of 10 per cent. of the cost of the line, and, in practice, amounts to from £7 to £8 per annum, which in view of the average farm bill for current



Electrically-Driven Corn Kibbler, Hereford.

can be safely given by the consumer; speaking generally, one-third of the energy is required for lighting and two-thirds for power. As previously indicated the electric motor has been very generally adopted in the old city itself, where we believe only a very few gas engines have survived its introduction.

Hereford is a centre of the cider industry and its five cider mills have some 300 H.P. of motors installed, the cellar lighting and refrigeration plants offering long-hour loads. Then there are three brewery consumers, one being electrically equipped throughout; five saw mills, a tannery and a tile works.

A particularly desirable consumer is a flour mill operating for 120 hours a week, with a 61-KW. average demand; electric ovens are used in this mill for both baking and moisture tests.

Two 60-H.P. electrically-driven turbine pumps—two 20-H.P. automatic pumps for high-pressure supply are also in use—at the waterworks provide an easily adaptable load and the saddlery, leather, hay and corn businesses associated with a country town have largely adopted small motors, so that in all over 2,000 H.P. of motors has been installed, which consumed roughly a million units last year for industrial driving.

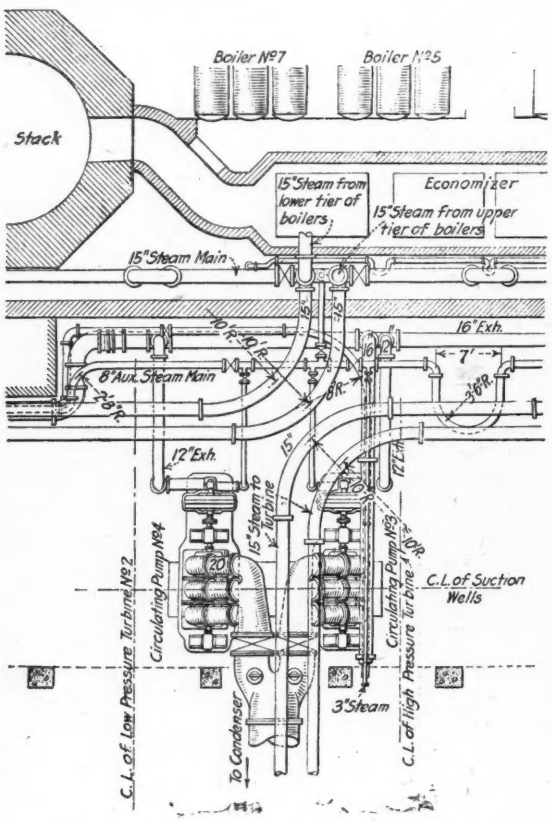
Copper.—Returns for May 31st, 1915, as set forth in Messrs. H. R. Merton & Co.'s statistical tables, again show an increase in visible supplies. The quantity, 34,090 tons, is 2,603 tons higher than for the end of April. English visible supplies have increased by the unusually large figure of 3,936 tons during the same period.

In detailed supplies a gratifying increase in European arrivals from North America is to be noted. This quantity, 31,085 tons, is only 3,315 tons under the average for the 12 months preceding August, 1914. Spain and Portugal exported to England and France during the month a quantity largely in excess of the pre-war average. Other countries (not specifically mentioned) contributed 8,166 tons, against a pre-war average of 4,910. Chile shipments are rather low for the month, but it must be remembered that they were high in April. Australian shipments are still a third below pre-war average.

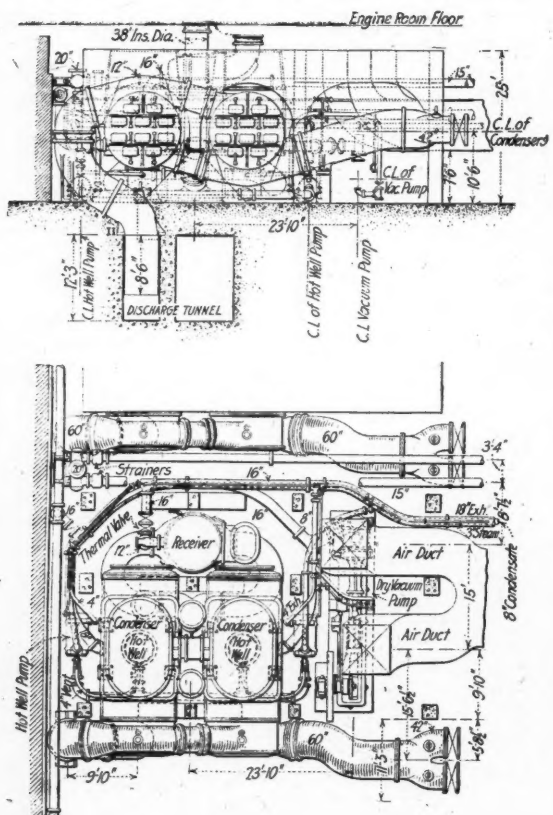
Total deliveries are 10 per cent. under pre-war average. The slowness with which the price has increased would appear to point to a fairly even balance between supplies and consumption.

THE NEW TURBINE PLANT OF THE INTERBOROUGH CO., NEW YORK.

AT the present time the reconstruction of the Seventy-Fourth Street station of the Interborough Rapid Transit Co., in New York, is being carried out with a view to meeting the increasing demand for power on the elevated lines.



CIRCULATING PUMPS AND PIPING, 30,000 KW. TURBINE.



This station, which was built in 1901—14 years ago—and excited considerable interest at the time, contained eight 12,000-H.P. Allis vertical-horizontal Corliss engines, driving 11,000-volt Westinghouse revolving-field alternators at 75 R.P.M., and having a steam consumption in recent times of 17·3 lb. per KW.-hour.

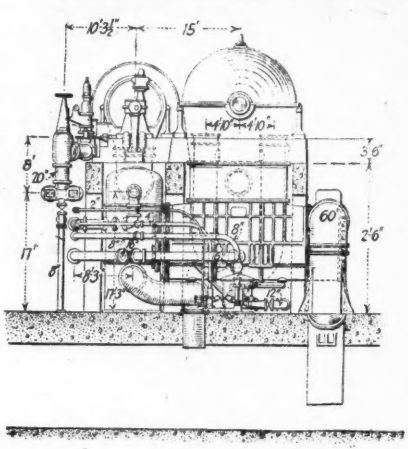
Later on there was added a 7,500-KW. Westinghouse turbine unit. Originally the engines were coupled to Worthington jet condensers, but in 1903 these were converted to barometric type condensers.

In the boiler house there were 64 Babcock boilers, each containing 5,200 sq. ft. of heating surface and six each of 6,000 sq. ft. heating surface; all were equipped with Roney stokers, and the gases were passed through Green economisers to four 278-ft. Custodis brick stacks. The generating plant operated on dry saturated steam at 160 lb. pressure, and with a vacuum of 26 in. The following remarks on the reasons for breaking up and replacing the engine units are quoted from *Power*:—

"The economy and the excellent physical condition of the units have caused many to wonder why low-pressure turbines were not connected to them, as practised with such satisfactory results at the company's Fifty-Ninth Street station. Briefly, the chief reasons are these: First, the economy of the turbine as a prime mover at the time of the Fifty-Ninth Street installation was not nearly as good as at present. Secondly, the engines at Fifty-Ninth Street, in addition to being in excellent physical condition, were designed for a higher pressure than those at Seventy-Fourth Street, and, quite important, they have poppet valves in the high-pressure cylinders, adapting them to high-pressure superheated steam, while this advantage is not possessed by the Corliss-valve units at Seventy-Fourth Street. Thirdly, the complete expansion turbines (turbine and generator combined) now going in at Seventy-Fourth Street were bought at a comparatively low figure—about one-third the price per kilowatt paid for the engine units. Fourthly, it is necessary to economise on space at Seventy-Fourth Street, and complete expansion turbines accomplish this far better than combination units."

The reconstruction will involve the installation ultimately of eight 30,000-KW. turbine units, but at present three of these sets are being substituted for four 12,000-H.P. (7,500-KW.) engine units, leaving four engine units and the 7,500-KW. turbine unit of the original plant; for one-half of the boiler plant opposite the turbines, the Roney stokers are being replaced by Taylor underfeed stokers, superheaters are being added and the economisers removed; turbine-driven feed pumps are also in part replacing motor-driven pumps and the main switchgear is being rearranged and reactances added.

The new turbine units each consist of two separate turbo-alternator sets side by side; one, the high-pressure set, consists of a single-flow turbine running at 1,500 R.P.M., while the other, the low-pressure set, consists of a double-flow machine running at 750 R.P.M. The turbines are of the reaction type throughout and are coupled through a large steam receiver. The arrangement was chosen to simplify design problems, particularly those relating to temperature range, blade speeds and steam congestion. The reliability of smaller units is also secured. Each complete unit rests on a steel frame foundation encased in concrete, leaving a good deal of space below for condensing plant, &c. A twin-shell Worthington surface condenser is placed under the turbine unit, hung from the turbine bedplates, but with the weight carried on springs. One shell is connected to each low-pressure exhaust outlet; the total tube surface is 50,000 sq. ft., and the condenser is designed to deal with 350,000 lb. of steam an hour with water at 60° F., maintaining a vacuum of 97 per cent. (29·1 in.).



CONDENSING PLANT ARRANGEMENT, 30,000-KW. TURBINE.

The circulating water for the twin condenser is supplied by a pair of triple centrifugal pumps of 75,000 gallons per min. capacity, which deliver to the two shells in parallel through a 60-in. pipe, the water being drawn through a revolving screen at the entrance to the inlet tunnel from the river. Each pump is driven by a 240 H.P. turbine, and one pump unit will carry the winter load.

The twin condensers are rigidly bolted to the turbine exhaust flanges, and a 36-in. equalising connection with a copper expansion joint is provided between the two shells, and in order to allow freedom of movement of the latter, the water pipe connections are made with rubber expansion joints. The condensate pumps for each unit are turbine-driven centrifugals of 800 gallons a minute capacity each, one pump being spare. Two cross-connected reciprocating air pumps are provided for the twin condenser, one being sufficient for the complete unit.

The pipe arrangement provides for delivering the condensate and auxiliary exhausts to a Hoppes open-type feed water heater; the receivers and the latter are also coupled through a heat-balance valve, the function of which is to interchange steam between the two according to which has the higher pressure.

At about 27,000 KW. the receiver reaches atmospheric pressure and at 32,000 KW. it is at about 3 lb. gauge pressure.

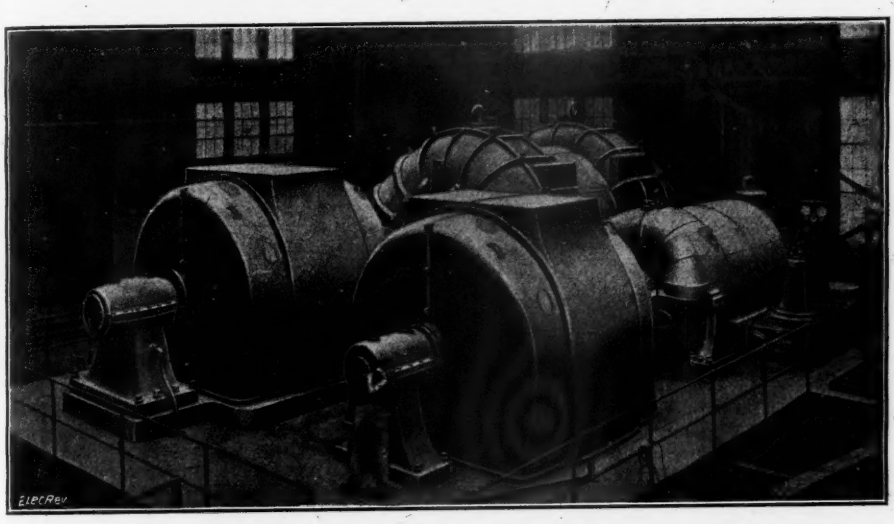
The feed heater, to which reference has been made, is 9 ft. diameter and 21 ft. long, with a capacity of 1,600,000 lb. per hour; it contains 240 pans, each 4 ft. long, having a total area of 3,400 sq. ft.

The heater was installed partly because certain economisers had been removed to increase the effective flue area and partly owing to the good supply of exhaust steam from auxiliaries.

Turning to the boiler plant, which has been operated at 160 lb. pressure, although designed for 212 lb. with a factor of safety of 5, one half the boilers are now to be operated at 215 lb. pressure, 200° superheat, and the necessary alterations to fittings are being made, superheaters added, &c. Taylor underfeed stokers are being installed in place of the old ones, it being calculated that while under the old engine conditions a maximum of 1,150 KW. per stoker was obtainable, under the new turbine conditions 3,750 KW. will be satisfactorily carried.

Thus under the old conditions eight boilers were allowed for one 7,500-KW. unit, while the same number under the new conditions will be allowed for each 30,000-KW. unit.

In the boiler basement four triplex feed pumps have been removed, and three turbine-driven centrifugal pumps, sufficient for the entire plant, installed; for each pair of boilers there is one turbine driving two stoker fans direct and the stokers also through helical reduction gears from the blower shafts.



TURBINE SET OF 30,000 KW., SEVENTY-FOURTH STREET STATION, NEW YORK.

The electrical switching arrangements have also been reconstructed to provide against the large amounts of energy which will now be concentrated on short circuit.

Between the generator and main bus-bars there is a 5 per cent. reactance, and between it and the auxiliary bus-bars is a 2 per cent. reactance.

The main bars are sectionalised through oil switches and groups of feeders run from each section. The 5 per cent. reactance coil is about 8 ft. 6 in. long, and the 2 per cent. coil 3 ft. 6 in. long, both being 4 ft. 6 in. diameter.

The generators, which are ventilated by rotor fans, the air being discharged into the boiler house, have about 8 per cent. reactance.

The steam consumption curve for the new units is a flat one, falling from 12·07 lb. per KW.-hour at 15,000 KW., to 11·27 lb. at 25,000 KW. (apparently the most economical load), and then rising to 11·63 lb. at 30,000 KW.

The steam consumption of the auxiliaries at the most economical load is 7·5 per cent. of the main turbine steam consumption, and 6 per cent. at full load.

The power consumption of the auxiliaries is 1·4 per cent. of the main turbine power at full load.

For the above particulars we are indebted to our American contemporaries, *Power* and the *Electrical World*, and to the latter for our views.

Cinematograph Exhibitors' Association.—The annual conference of the Cinematograph Exhibitors' Association of Great Britain and Ireland (Ltd.), has been held in Edinburgh. Following the meeting of the Association, which was held in private, a luncheon was given, presided over by Mr. R. C. Buchanan, president of the Edinburgh branch. Various speakers paid a tribute to the cinematograph industry's work on behalf of recruiting, while it was pointed out that there are at present 67,000 theatres in the country, and that the Association represented 2,000, with probably an average capital of £5,000.

LOAD FACTOR, OUTPUT AND COST.

BY C. ASHMORE BAKER, A.M.I.E.E.

(*Concluded from page* 810.)

ATTENTION is called to the following typographical errors in the preceding portion of this article (ELEC. REV., June 4th, p. 808):—

The equation for ρ immediately before equation (6) should be $\rho = 11{\cdot}8/\lambda^{0{\cdot}831}$; that is to say, the value 0·831 is an exponent, and not a multiplier. Similarly in equation (9) the value 1·027 is an exponent.

In the paragraph following equation (9) the dotted curve referred to is in fig. 1, not in fig. 3.

In fig. 12 capital expenditure is dealt with. The logarithmic diagram in the right-hand top corner represents the entire list of 200 municipal undertakings in London and the provinces, with which we are dealing, and connects total capital and maximum load. The curves in the main diagram represent capital expenditure per kilowatt of maximum load for the various classes of undertakings.

With the exception of the London group, whose capital per kilowatt stands high almost throughout, the curves are not very divergent, and there is a good deal of interlacing; thus the ordinary provincial town curve starting highest crosses all the others before the 4,000-KW. point is reached, while that for the coal area towns starting lowest finishes well above the general average, and some 25 per cent. above the ordinary provincial towns.

A noticeable feature of the general form of these curves is their tendency to flatten out above the 5,000-KW. point, owing probably to the fact that the lower cost per kilowatt of large generating sets is counterbalanced by the higher cost per kilowatt of extended supply areas.

INFLUENCE OF OWNERSHIP.

We now come to that highly controversial subject, the question of ownership, and I offer no apology for presenting this aspect of the question to the readers of this journal, believing, as I do, that the science of political economy is as much the province of the engineer as any other science; indeed, when we consider how inextricably finance is interwoven with engineering, it is safe to say that it is even more our province than many branches of even *physical* science.

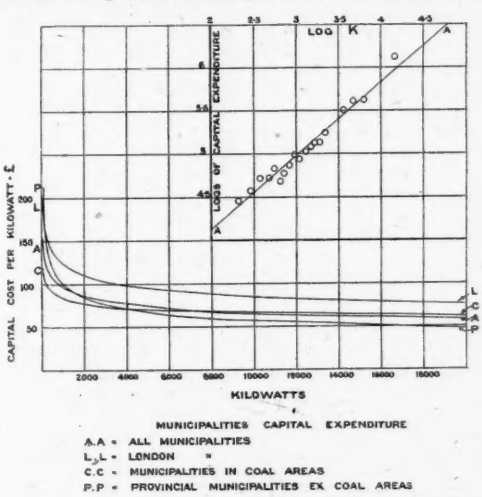

LOG K
LOGS OF CAPITAL EXPENDITURE
CAPITAL COST PER KILOWATT - £
KILOWATTS
MUNICIPALITIES CAPITAL EXPENDITURE
A.A = ALL MUNICIPALITIES
L.L = LONDON "
C.C = MUNICIPALITIES IN COAL AREAS
P.P = PROVINCIAL MUNICIPALITIES EX COAL AREAS

FIG. 12.

The question presents itself to me in the following form:—Under which of the two systems of ownership, public or private, can we produce and sell the largest number of units at the lowest average cost?

In asking ourselves this question, and endeavouring to solve it by applying the methods I have described, we must bear in mind

that our comparison must take into account not only the elements of size and load factor, but we must also compare our two types of ownership class by class. I have, therefore, divided the company-owned undertakings into three classes corresponding with those into which the municipalities have been separated.*

Having calculated the K λ diagrams for each group in the usual way (see fig. 9) I have worked out the cost curve corresponding with this K λ diagram under each heading from the standard equations. Taking the values of this curve at all points at 100, I have worked out the ratios thereto of the costs for corresponding values of K for the two types of undertaking in the group to be studied.

Thus curve B, fig. 9, gives us the relation between load factor and maximum load for London undertakings owned by municipalities. If we work out from these co-ordinate values of K and λ a corresponding curve for total cost from the equation the data of which are given in Table I E, and divide the ordinates of fig. 10 (full line) by the ordinates of our new curve, we shall obtain a series of values giving us the dotted line in fig. 13.

This is a curve of percentages and represents the amount per cent. by which the total cost per unit in the case of London

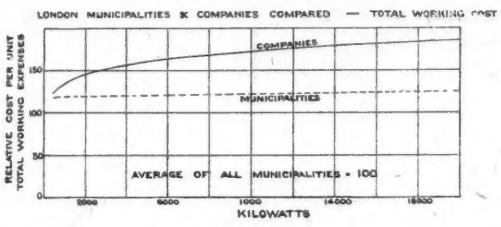

LONDON MUNICIPALITIES & COMPANIES COMPARED — TOTAL WORKING COST
RELATIVE COST PER UNIT TOTAL WORKING EXPENSES
COMPANIES
MUNICIPALITIES
AVERAGE OF ALL MUNICIPALITIES = 100
KILOWATTS

FIG. 13.

municipal undertakings exceeds the general average cost per unit incurred by municipalities as a whole.

The full line curve in fig. 13 is calculated in the same manner so that we are comparing companies and municipalities class for class, size for size, and load factor for load factor.

Now let us look at the result. Dealing first with the provincial undertakings and taking the working expenses item by item, in some the Local Authorities show better results, and in others the contrary is the case. Thus on the items Oil, Waste and Stores, Wages of Workmen, and Rent, Rates and Taxes, the municipal figures are higher, but in the items for Fuel, Repairs and Maintenance, and Management, the companies' figures are higher

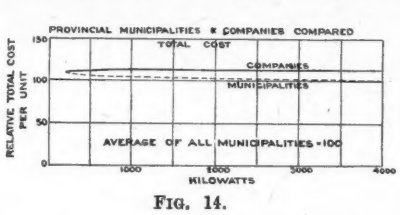


FIG. 14.

(for Management in particular, considerably higher) than the municipal figures, the general result being that the total cost to the companies is some 7½ per cent. higher than that for municipalities. (See fig. 14.) This result is naturally reflected in the price charged.

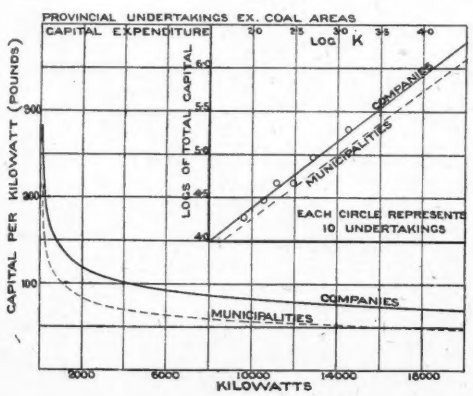


FIG. 15.

Turning to the London companies, there is not a single item, from the coal to the consumer, in which the companies' curve is not above, and considerably above, the municipal curve, the result being that the consumer pays to the company something over 20 per cent. more for his energy than he would pay to a municipality.

It should be noted, however, that load factor is an inverse function of the price charged, as will be seen later, and it is a question, therefore, if we are quite justified in basing our comparison on equal load factors; we should, I think, be quite justified in basing it simply on equal outputs were we considering the matter from the consumer's point of view. In such a comparison the municipalities would show to greater advantage still.

Figs. 15 and 16 show the capital expenditures of the provincial and London companies respectively, and in dotted lines the corresponding municipal capital expenditures. And here I must confess to an unpardonable crime against statistical ethics. Fig. 16 has been deliberately "faked."

In this figure each circle represents a single undertaking instead of a group, hence they are somewhat scattered.

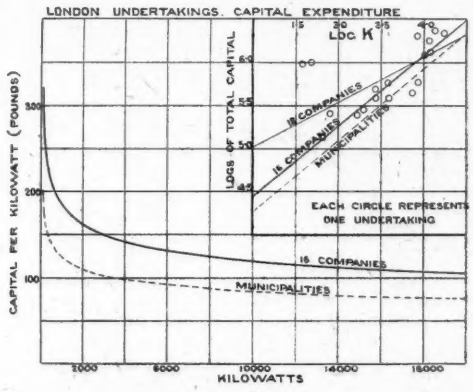


FIG. 16.

Now, if we take the whole 18 companies within the boundaries of Greater London, given in the returns which we are studying, we get a logarithmic diagram represented by the thin full line. If, however, we eliminate the two undertakings represented by the two circles near the top left-hand corner of the inset, and calculate our average from the remaining 16 concerns, we shall get the thick full line, which it will be noted is fairly parallel with the dotted municipal line. The thick black curve is calculated from the "faked" thick black line, and that is my offence.

The difference between the black and dotted lines represents, I suppose, dilution of various kinds.

Thus we have an answer to the question formulated above as to the most economical type of ownership; namely, that neither economy of first cost nor economy of administration or working is to be gained by private ownership.

Now if we look at fig. 17, we shall get an idea of how the question affects the consumer.

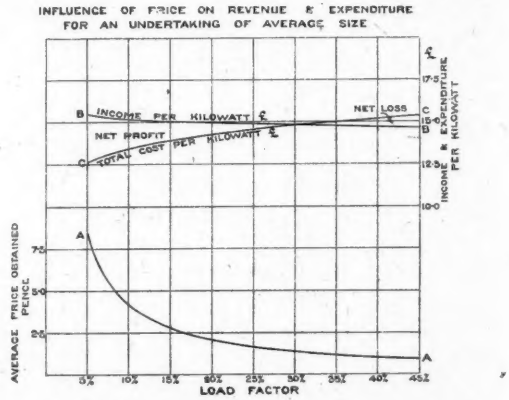

INFLUENCE OF PRICE ON REVENUE & EXPENDITURE FOR AN UNDERTAKING OF AVERAGE SIZE
B INCOME PER KILOWATT
NET LOSS
NET PROFIT
C TOTAL COST PER KILOWATT
INCOME & EXPENDITURE PER KILOWATT
AVERAGE PRICE OBTAINED PENCE
A
LOAD FACTOR

FIG. 17.

Curve A shows the relation between price and load factor for an undertaking of average size as derived from equation (8 and 9).

Curve B is the income per kilowatt obtained by multiplying the corresponding values of A by the load factor and by 87·6/240.

Note that this curve descends as the load factor increases.

Curve C is the total annual cost per kilowatt, and is arrived at by multiplying the values obtained from equation (6) by 87·6/240, and adding to the product a sum of £6 6s., being 7½ per cent. capital charges on an expenditure of £88 per kilowatt.

Note that this curve is an *ascending* curve, and that the vertical distance between B and C represents net profit as far as the point at which they cross. The distance separating them beyond this point would be net loss.

Now observe the difference in policy as between company and municipality, which these curves suggest. The object of the company is to keep net profits as high as possible, hence it has no interest in aiming at high load factors unless it can obtain

* As there are only some half-dozen companies working in the coal areas, some of whose costs are above, and some below, the municipal average, I have neglected this class as offering no evidence either way.

exceptionally high relative prices; the trend of its policy is to keep prices up, as, in fact, the companies as a rule have done.

The object of the municipality, on the other hand, is to sell as many units as possible at the lowest price compatible with financial stability. (I am speaking now, of course, of the more enlightened municipalities.) The municipal engineer, therefore, is continually working towards the crossing point of the curves and endeavouring to push that crossing point as far as possible to the right by lowering his working expenses, and increasing his load (compare fig. 7). The consumers respond by buying 40 per cent. or 50 per cent. more units per head of population where Local Authorities own the supply than they do in areas supplied by companies.

Fig. 18 gives us the relation between average price charged and the growth of sales in units per head of population per annum. It is taken over a period of five years, and inasmuch as the equation to this curve is practically the same for both companies and municipalities, it may be taken as being independent of ownership.

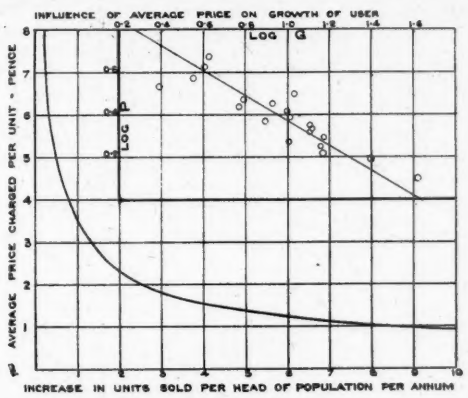

INFLUENCE OF AVERAGE PRICE ON GROWTH OF USER
LOG G
LOG p
AVERAGE PRICE CHARGED PER UNIT - PENCE
INCREASE IN UNITS SOLD PER HEAD OF POPULATION PER ANNUM

Fig. 18.

When we consider that the average cost of a municipally supplied unit was, for the year 1911-12, 1·62d, as compared with 2·37d. charged by the companies, the sociological value of public ownership becomes apparent.

Thus it is difficult to discover (outside the pockets of shareholders and directors) any justification for the general principle of the supply of electricity by private enterprise.

There are many questions of great interest which the methods of analysis and comparison, which have been described, would elucidate. Such questions are bulk supply, group ownership of undertakings, the relative economy of different types of plant, questions of tariff, &c., and the author trusts that the foregoing suggestions, which do not pretend to be more than a rough preliminary study of methods, may produce results of greater value from the hands of specialists.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Munitions of War.

In this time of National stress I suggest the immediate organisation of the workshops of the many electricity supply works in the Kingdom, both municipal and company owned, with a view to producing shells and other suitable munitions of war.

I suppose all these works have already lost some men to the Colours, but in every case they are compelled to retain enough men to deal effectively with any case of emergency that may arise in connection with these undertakings. These men could each do a certain amount of overtime for the good of the Empire. Moreover, they are for the most part skilled mechanics, and doubtless the Corporations and companies concerned would readily grant them the full use of their machine tools and workshops.

Possibly also additional service could be obtained from engineers resident in the towns or districts where the works are situated, and thus the plant could be maintained on practically continuous duty excepting when required for the pressing needs of the power station itself.

In this way a considerable source of production will be immediately tapped which otherwise must apparently remain dormant. Presumably the scheme would be worked in conjunction with the various munition committees which are being formed in the manufacturing centres. I feel sure the authorities would find both the managers and men of the electric power stations willing and anxious to do all they can to help the common cause on such reasonable terms as the Government are in a position to offer.

Geo. Wilkinson.

Electricity Department, Harrogate,
June 5th, 1915.

Automatic-Lift Accidents.

May we add a note on this subject endorsing Mr. Rosenbusch's suggestion that Mr. Broadbent, while justifiably criticising a lock of the type he illustrates, overlooks the qualities of other locks which have been available for many years.

It is, for instance, a very considerable period since we first sent out a lock which was free from all the defects enumerated by Mr. Broadbent, and in its present form it not only meets all the requirements laid down by Mr. Rosenbusch, but also another which in our view is a vital one, viz., that it shall be absolutely impossible to unlatch the gate without first cutting off current.

Mr. Butler asks for evidence as to the maintenance of an arc after an electric lock contact is broken. The writer has seen this on very many occasions, and holds the belief that under certain conditions it is possible in most of the locks in use. The conditions arise most frequently in automatic machines, but the arc can be obtained sometimes with car switch control.

It would only be mischievous to describe the conditions, but the cure is obvious—increase the length of break.

That of course means an increased length of stroke for all moving parts and a larger box, with cost in proportion. The chief difficulty in the way is the reluctance of our good friend the architect to provide the requisite space, or to have beautiful doors and enclosures disfigured by "those barbarous engineering fellows." So small boxes with short breaks are the rule.

An evil influence in automatic-lift switch design is born of the fact that in most control systems several switches are intended to make circuit only, and never to break it. Therefore, it is argued, short breaks will suffice, and that will cut down cost. But things do not always run as intended, and owing to some failure at a quite different point, due to dirt or bad lubrication, a poor innocent little "making" switch is called upon to break a comparatively heavy circuit, and trouble results.

In view of this contingency we have recently redesigned all our switches for every class of service, giving every switch a "breaking" capacity equal to the maximum current passing. We have suppressed the purely "making" switch.

Smith, Major & Stevens, Ltd.
C. G. Major, *Chairman.*

Northampton, *June 3rd*, 1915.

Cable Shortage.

I was much interested in reading in your issue of May 28th the letter from a contractor *re* above. My firm has had the same experience with wire supplied by one of the oldest English cable manufacturers, the deficient coil being 15 ft. short of the six switch wires our man should have got out of a full coil. The fact of finding one coil over the proper length does not remove the doubt in the contractor's mind as to whether he has been, and is, getting what he pays for; when one finds such errors with firms of high standing, it lessens the desire to deal with them.

Your correspondent, in finding a coil 5 yards too long, was more fortunate than we were; we measured three new coils in the presence of the local agent, and found only one to be correct length, viz., 110 yards, the other two coils being 4 ft. and 4 ft. 4 in. short respectively.

Perhaps if others would tell their experience in this direction, it might lead to the contractors getting full measure in future.

I need hardly point out that these deficiencies, small in themselves, mean an enormous saving of material to the larger manufacturers, increasing their dividends at the expense of the contractor, who has quite enough to look after, without measuring each coil of cable from the manufacturers.

A.M.I.E.E.

Appointments Vacant.

At the present time, when employers are asking for Associates of the Electrical Engineers Institution at labourers' wages, it would save the time of those looking for responsible posts to separate such vacancies below £2 per week from those up to £5. Those above that figure (when they occur) could be placed first to show budding youths what might happen to them.

I also suggest a home for those too old at 30, as that appears to be the age limit for most of the advertised posts.

In a Good Post.

Cab Signalling.

So far as Mr. Hans von Kramer's *argumentum ad hominem* is concerned, I surrender to him without offering so much resistance as a scratch of the pen. He has my unqualified permission to say that I cannot distinguish between Hertzian radiation and Faradic induction; that I know nothing (and think less) of the Railophone; and that I do not know the difference between the mantissa of a Naperian logarithm and the n-th differential coefficient of a trigonometric function. Of one thing only do I solemnly warn him: viz., that he will find it a far more stupendous task to enumerate my intellectual deficiencies than to tabulate the *real* merits of the Railophone, after the latter have been discovered.

I have spent many a weary hour calculating curves, frogs, and switches over which, for several years, trains have been running. I am, therefore, dimly conscious of the millions of times per month trains run over switch rails which, because they must be movable, cannot be fastened at the ends so easily as ramps can. The danger Mr. von Kramer mentions of a ramp being torn up is of the same kind as, and of no greater degree than, the danger to

a switch rail. When one reflects that the accidental tearing up of switch rails, by objects wrongly hanging down from trains, does not occur as often as one time in a year, one can see how much practical importance attaches to the solitary exception which Mr. von Kramer cites.

I think that some rather authentic Railophone information may be obtained from British patent specification 19,467 of 1912 (of which, no doubt, I am profoundly ignorant), since that specification bears the name of Mr. Hans von Kramer. By examining fig. 2 of this specification, a nasty man like me might suspect:—(1) That any line-wire portion 3A would produce inductive effects towards the line of corresponding signals C as readily as the parallel portion of co-operating local loop *y* does; (2) that this same criticism applies in the opposite direction; and (3) that these wires produce such effects quite as energetically outwards from the track which they are intended to govern as they do either inwardly towards the centre line of that track or directly upwards.

By regarding the two tracks of this figure as the inner two of a four-track route, we at once see that each line-wire will emit inductive impulses as readily towards the wrong (adjacent outer) track as towards the right track. Indeed, in the more recently published descriptions this short-distance radiation (how iconoclastic!) to the "other" track is actually employed, at the local loops on double-track routes, for effecting the danger warnings on the trains.

It is in view of these facts that I shall be so happy when Mr. Acfield publishes the circuit diagrams and general descriptions (without taking the trouble to give details) which will enlighten humanity by revealing the "right lines" on which the Railophone can rationally be applied in the case of a double-track junction with a four-track route.

Wm. H. Dammond.

Nottingham, *June 7th*, 1915.

Your correspondent, Mr. von Kramer, must have either a very low opinion of the mental calibre of your readers or a very slight regard for his own reputation for truthfulness. Otherwise, he would not have applied the expression "illogical outburst" to Mr. Dammond's pertinent and clearly reasoned letter; nor would he have written cheap nonsense to the effect that he (Mr. von Kramer) did not think that Mr. Dammond would know the difference between the Faradic and the Hertzian classes of cab signals. Is Mr. von Kramer not aware that the very terminology, Hertzian and Faradic, as applied to wireless cab-signal classes, was introduced by Mr. Dammond? During the 20 months that Mr. Dammond's full-size tests—real tests—were taking place, more than a dozen persons spent a Saturday afternoon testing the mechanism, every person having had years of experience at electric light and power works, telephone or telegraph testing, or railway signalling. We were so surprised at the merits of the apparatus that we requested permission to return and bring others the next Saturday. Mr. Dammond replied that we were at liberty to bring anybody we wanted, and as many as cared to come. Not less than 30 came next time. On both occasions Mr. Dammond turned the whole installation over to us, instructing the driver to run the locomotive just as we dictated, and informing us that he hoped we would not hesitate to earth or break any wires, or other parts, as might be found necessary for thorough testing. From the experience gained on these two visits I know that in the Dammond system:—

(*a*) Full protection is given against wrecks like Bromford Bridge and Tottenham Hale as well as Aisgill, because "stop" and "run slow" are both indicated audibly and visually, and in such a way that a driver or fireman always knows which is intended for him.

(*b*) There is no danger of false clear signals being accidentally produced by induction or conduction from external electric sources.

(*c*) No errors, except safe ones, can result from earthing or open-circuiting or both.

(*d*) There is no danger or difficulty in the way of applying the system to electrified railways.

If the Railophone fails with respect to any of these four specifications, it is inferior to the Dammond system. Will Mr. von Kramer permit a committee of trained men, including utter strangers to himself, to make the same searching tests of his Midland installation as we made of the Dammond equipment? Will Mr. Acfield and Mr. Sayers, of the Midland Railway, concur with Mr. von Kramer in granting this permission?

E. Sowberg.

Nottingham, *June 7th*, 1915.

Overseas Trade—Nothing Done.

At the risk of being identified with the "I told you so" type of adviser, I would like to point out in respect to your very appropriate comments on the efforts (?) of the I.E.E.-B.E.A.M.A. group, that the result is exactly as I have continually pointed out or foretold right away from your issue of September 11th last. All over the world I have nearly always found technical institutions and trade associations either "lame ducks" or professional muddlers of an advanced type.

As all electrical people are not tied to the I.E.E. or the B.E.A.M.A., why not commence an individual independent overseas trade campaign?

Arthur Mallord Turner, M.A.

Wimbledon, *June 7th*, 1915

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

7,722. "Telephone or other electrical transmitter or receiver diaphragms." B. A. PILKINGTON. May 25th.

7,723. "Electric bomb-dropping device." F. PAMMENT. May 25th.

7,728. "Electrical resistances." B. THOMAS & E. THOMAS. May 25th.

7,757. "Electric starting systems for internal-combustion engines." C. F. KETTERING & W. A. CHRYST. May 25th. (Convention date, June 24th, 1914, United States). (Complete.)

7,758. "Electric starting systems for internal-combustion engines." C. F. KETTERING & W. A. CHRYST. May 25th. (Convention date, July 16th, 1914, United States.) (Complete.)

7,796. "Cable drums for field telephones and telegraphs." J. H. REID. May 26th.

7,805. "Lamps for signalling." JANDUS ARC LAMP & ELECTRIC CO., LTD., & G. A. MURRAY. May 26th.

7,813. "Dynamo-electric machines particularly applicable for engine-starting systems." C. F. KETTERING & W. A. CHRYST. May 26th. (Divided application on 13,057/14.) (Convention date, September 13th, 1913, United States.) (Complete.)

7,826. "Electrical transformers." S. ZIANI DE FERRANTI & FERRANTI, LTD. May 26th.

7,827. "Electrical transformers." S. ZIANI DE FERRANTI, J. ROOTHAAN, & FERRANTI, LTD. May 26th.

7,829. "Process for manufacturing metallic filaments for incandescent electric lamps and for other purposes." K. NISHIMOTO. May 26th. (Complete.)

7,840. "Electric signals." A. C. BROWN. May 27th.

7,847. "Sparking-plugs." F. W. MILLER. May 27th.

7,868. "Röntgen or X-ray apparatus." C. B. BURDON. May 27th. (Siemens & Halske Akt.-Ges., Germany.) (Complete.)

7,869. "Röntgen tube apparatus." C. B. BURDON. May 27th. (Siemens & Halske Akt.-Ges., Germany.) (Complete.)

7,923. "Slot closing devices for dynamo-electric machinery and other electric apparatus." SIEMENS SCHUCKERTWERKE G.M.B.H. May 28th. (Convention date, May 30th, 1914, Germany.) (Complete.)

7,946. "Portable or field telegraphs." S. F. RUTLEY & F. RUTLEY. May 28th.

7,953. "Wireless telegraphy." A. J. ROBERTS. May 28th.

7,963. "Telephone instruments." G. G. TURRI. May 28th. (Convention date, June 1st, 1914, Australia.) (Complete.)

7,964. "Electric cooking-apparatus." DEUTSCHE GASGLUHLICHT AKT.-GES. (AUERGES). May 28th. (Convention date, December 12th, 1914, Germany.) (Complete.)

7,979. "Protected or armour-clad electric switches." H. H. BERRY & W. J. MARKHAM. May 29th.

7,987. "Rotary converters." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.)

8,004. "Insulating-material and method of producing same." H. B. MACFARLAND & R. J. SHOEMAKER. May 29th. (Complete.)

8,010. "Electro-magnetic shuttle-driving apparatus for looms for weaving." E. BACHELET. May 29th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1914.

8,568. GASEOUS OR VACUIZED DETECTORS FOR RADIANT ENERGY, AND METHOD OF CONTROLLING THE ACTION THEREOF. J. H. Hammond. April 4th.

10,275. APPARATUS FOR THE ELECTRICAL TRANSMISSION OF THE ENERGY OF A HEAT MOTOR TO THE DRIVING WHEELS OF A VEHICLE OR THE LIKE. P. Biles. April 25th.

11,436. PROTECTIVE DEVICES FOR ALTERNATING ELECTRIC CURRENT MACHINES. British Thomson-Houston Co. & F. H. Clough. May 8th.

11,739. INSULATING DEVICES FOR ELECTRIC TRACTION SYSTEMS. British Thomson-Houston Co. (General Electric Co.). May 12th.

11,794. ELECTRIC CIRCUIT BREAKERS AND SWITCHES. D. K. Morris, & Morris & Lister, Ltd. May 13th.

11,832. PROTECTIVE DEVICES FOR ELECTRIC CIRCUITS. British Thomson-Houston Co. (General Electric Co.). May 13th.

11,928. GENERATING ELECTRO-MAGNETIC OSCILLATIONS OR HIGH FREQUENCY CURRENTS. R. Arno. May 14th.

11,934. METHOD AND MEANS OF PRODUCING OSCILLATORY CURRENTS OF ELECTRICITY OF SMALL DECREMENT AND CLOSE WAVE-TRAINS FROM ALTERNATING AND CONTINUOUS CURRENTS OF ELECTRICITY. H. Manders. May 14th.

11,950. PROCESS FOR THE TREATMENT OF ORES AND SOLID SALTS BY ELECTRO-CHEMICAL REDUCTION. A. A. M. Hanriot. May 14th. (May 22nd, 1913.)

16,833. CONTROL GEAR FOR ELECTRIC BURGLAR ALARMS. Lichtenfield Burglar Alarm Co. & S. Litchfield. July 15th.

17,811. SYSTEM FOR THE GENERATION OF ELECTRIC CURRENTS. C. F. Benitez. July 28th.

18,143. ELECTRICAL CONDUIT SYSTEMS. M. J. Railing & T. Taylor. July 31st.

18,801. VALVE-OPERATING MECHANISM FOR ELASTIC FLUID TURBINES. British Thomson-Houston Co. (General Electric Co.) August 18th.

19,433. MEANS FOR PRODUCING OSCILLATING CURRENTS OF HIGH FREQUENCY. A. H. Cohen. September 4th.

21,488. AUTOMATIC CUT-OUTS FOR ELECTRICAL INSTALLATIONS. A. H. Midgley & C. H. Vandervell. October 24th.

22,435. ELECTRIC SWITCHES. T. E. Barnum & W. E. Date. November 12th. (November 13th, 1913.)

22,915. ELECTRICALLY-HEATED SHAVING POTS. A. J. Miller & G. A. Miller. November 23rd.

1915.

823. AUTOMATIC SWITCHING APPARATUS FOR ELECTRICALLY-ILLUMINED SIGNS AND THE LIKE. E. Savoye. January 18th. (January 20th, 1914.)

3,521. PORTABLE ELECTRIC BATTERY LAMPS. M. Goodfellow & New British Ever-Ready Co. March 4th.

3,672. ELECTRIC CIGAR OR CIGARETTE LIGHTERS. G. A. Vandervell. March 8th.